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REGISTRATION OF ELECTRICIANS.

As has been noted in these columns from time to time, a few of the larger of the American cities have adopted the practice of requiring some sort of license or municipal registration of persons who undertake to do electric wiring. In some of the other cities efforts to establish such a practice have met with failure.

It appears that in some instances local associations of electrical workers have felt that their own endorsement of a member of the association was a sufficient guarantee of skill, and have therefore used whatever influence they could command to prevent the requiring of an electrician's license by the municipality. In justice to organizations of this kind, it should be said that the policy of some of them of making a certain amount of experience and skill in electrical work a prerequisite for admission into the organization is a commendable one. When properly carried out this is bound to promote improvement in construction standards. To insist, however, that a duty or function of the local government be left to a trade association does not seem to be either wise or reasonable.

Further reasons for failure of efforts to require licenses of electrical workers have been that the interest of the public has not been properly enlisted in the matter, and that the fees which it has been proposed to charge the candidate for a license were so large as to make it apparent that the adoption of the plan would result in an unwarranted increase in the cost of electrical work, and also impose a hardship on the average electrician. Where there is municipal inspection of wiring, the public is rather generally inclined to the opinion that inspection itself should insure high-class work. The contractor, for example, frequently has to contend with the feeling on the part of his patrons that the services of men in his business should always be secured at the lowest possible cost, and that the inspector can be depended upon to make sure that only good work is done. In other words, the cost of the work is the concern of the property owner, and the quality of it that of the inspector. The fact is, of course, that the inspector has usually to be content with satisfying himself that only safe wiring is done. Even this is by no means always a simple task. If the city board of inspection had the opportunity to make the necessary investigation as to the ability of electrical workers and to permit only those found to be proficient

to have charge of electrical construction, it would make inspection much more effective, and, withal, much less costly. Moreover, it would be an excellent remedy for the widely prevalent and very deplorable custom of allowing any man who cares to do so to undertake to install wiring. Where the plan is being tried it seems to be working well. Honestly and conscientiously administered, it certainly should prove an excellent means of insuring a higher grade of electrical work.

The charges for the registration or licensing of an electrician ought not to be more than the actual cost of whatever examination of the applicant might be necessary, if, indeed, there should be any charge at all. Any movement to require a license which is a crafty effort to reduce the number of electrical workers in the field by requiring excessive fees and bonds difficult for most men to secure ought always to meet with disapproval. There seems to be no good reason why a system of municipal registration could not always be provided with the sole object of promoting high-class work, and at a cost not burdensome to the electrician himself nor to other electrical interests.

THE PROPER TREATMENT OF THE EXCITER.

The short paper on the applications and care of alternating-current motors which appears in another section of this issue can be read with profit by many practical electricians. While the article referred to does not contain much that is especially new, it does emphasize some important matters which are much too generally neglected. For example, most engineers and many electricians know that the excitation required to enable an alternator to deliver a given amount of power at a specified voltage is an inverse function of the power-factor of the load; and yet it frequently happens that in the smaller generating stations only sufficient exciter capacity to take care of a practically non-inductive overload is supplied. Then in case the load on the station becomes one of low power-factor, the exciter equipment is generally subjected to excessive loads in attempts to keep up the station voltage. Furthermore, it is the case sometimes that no ammeter is provided in the exciter circuit to enable the attendant to determine just when the current in this circuit has reached the maximum safe value. Such practice is decidedly bad.

It is well to give the question of power-factor some consideration not only in determining the proper exciter capacity but also in deciding upon the best method of drive for the exciter. If this machine be driven by an induction motor supplied with power from the alternator to which it furnishes excitation, the exciter unit is liable to slow down and stop in case a heavy and badly lagging load is suddenly thrown on the alternator. Where the throwing on of such a load is likely to occur with any considerable frequency, either through design or accident, some other method of drive for the exciter could often be employed to advantage.

LIGHTING OF COUNTRY ROADS.

Now that the electric lighting of our larger cities is well under way, the leaders of the central-station industry are directing their attention to the electrification of the small communities and rural districts. The most economical way to generate electricity for this purpose is in a large and favorably located central station serving a group of towns and the intervening farms. This gives a favorable diversity-factor and makes possible 24-hour service, for the scarcity of day load in the villages is made up by power load on the farms. The investment in transmission and distribution lines for such a scheme is quite high, however, and this has been the stumbling block to the carrying out of many such projects. The problem is, therefore, one of developing enough load along the lines through sparsely settled districts to make their construction remunerative.

Naturally the location of transmission lines of moderately high voltage by a new company with limited resources will be along the principal highways connecting the villages to be served electrically. An excellent revenue would be secured through this very location from the lighting of the road. The equipment involved, if tungsten lamps are used, is low in initial cost and upkeep. Lamps need not be spaced closely, since a low illumination of the path-finding order is all that may be needed. If the stretch of road to be lighted is remote from the station or substation, a time switch adjacent to the transformer can be used to close and open the lighting circuit. A cheap bracket construction can be used where dense, low-hanging trees do not abound; where the foliage is thick center-suspension construction is employed. Since the additional expense of providing the lighting equipment is relatively small, low rates for the service should prevail. Thus, from the engineering standpoint the problem is extremely simple and from the commercial side the desirability of the road-lighting load, together with the low rates at which it can be supplied, should stir up the commercial agents of the company to a realization that the securing of contracts from even hard-headed farmers is not insurmountable.

Little need be said as to the need and value of lighting at least our main highways. Any one that has ever gotten lost while strolling in the country on a moonless night will appreciate what inky darkness means. The lighting of the principal roads should prove a great social boon to a rural people in making it more agreeable and safe to visit friends and attend parties, concerts, etc. Like the telephone it will aid in relieving the isolation of farm life. It certainly will make it more pleasant for city people to visit the country. In quite a few districts considerable

profit is made by boarding city folks on their vacations. In such districts and near regular summer resorts road lighting should be installed first. As a demonstration it should easily convince farmers of its value. Large numbers of farmers need only to be shown the value of an improvement in order to adopt it.

As yet there has been but little agitation in favor of road lighting. Automobilists have sought it on much traveled highways, but practically nothing can be done without active local support. In rich agricultural districts it seems reasonable to believe that support for the movement can be expected from the prosperous farmers. During recent years they have taken up with many seemingly radical innovations. They are ready to dispense with the old kerosene lamp and are clamoring for electric lighting of their homes where these adjoin existing transmission lines. They see the value of electric pumping and miscellaneous electric power applications on the farm. Each new use of electricity has brought its fruits in decreased labor, greater comforts and increased desirability of farm life. Rural road lighting will give the farm another new aspect of progressiveness.

THE PATENT SITUATION.

In spite of the widespread demand for reform in the administration of the patent law, Congress adjourned this week without taking any action in the matter. For some years there has been a demand for such a change, especially with reference to procedure in the Patent Office and in the courts having jurisdiction over patent litigation. It is generally agreed that the present method of taking testimony in patent cases is undesirable and results in needless delay and expense. In the report of the Committee on Patents of the House of Representatives which was submitted on August 8, it was recommended that the taking of testimony before an examiner be discontinued and that patent testimony like any other kind be taken before a judge under the usual rules governing the admission of evidence and its compulsory production. The conduct of interference proceedings in the Patent Office is also in need of revision, as the present conditions not only result in great expense to inventors, but encourage practices which are inimical to the best interests of the inventors themselves. A resolution providing for an investigation of Patent Office conditions and methods was passed by Congress, and Mr. F. A. Cleveland has been made chairman of the commission having the matter in charge. It is to report by December 10 of this year as to how efficiency in the Patent Office and improvement in the conditions there can best be attained, and an appropriation of $10,000 is made available for the investigation.

In addition to these changes in administration, a demand for changes in the patent law itself has been accentuated by the decision handed down by the Supreme Court of the United States last spring in the case of Dick vs. Henry. This decision has the effect not only of making the violation of a patent license an infringement of the patent, but also makes the selling of material whose use with a patented article would be a violation of the license, also an infringement of the patent. The absurdity of the condition created by this decision is emphasized by an analogy in more ordinary business relations. Suppose that A rents a house and in the contract of lease agrees to a provision that it shall be used only for residence purposes. A then purchases from B a barber's chair with the intention of using it for business purposes upon the premises, A's intent in the matter being known to B. B is then not only made liable to the landlord for violation of the contract, but in the case where this contract is a license agreement B is also liable to be enjoined from selling chairs to any other person who contemplates the violation of a similar contract with the same landlord.

There has been much argument both pro and con advanced in the hearings of the Patent Committee for upholding and discarding this principle, which permits the owner of a patent to place in a license for its use any restrictions which he may see fit, and making a violation of such license an infringement of the patent. There is an urgent demand for a change in the patent law which shall give such contracts the same status before the law as any other form of contract. There is also a demand for a compulsory license in the case of those inventions which have not been worked after the patent has been granted. The substitute for the Oldfield bill, which was introduced by the Patent Committee but not acted upon, covers both of these matters, a compulsory license being obtainable in court after three years whenever patents have been assigned and suppressed. It provides further that the anti-trust laws shall apply to monopolies secured through a combination of patents and specifically defines any such restraint of trade to be unreasonable. This bill would also limit the duration of a patent to 19 years from the date of application, as well as to 17 years from the date of the grant. It will probably come up for action at the next session of Congress, along with supplementary bills providing for a reorganization of patent procedure.

It is to be most earnestly desired that at least some of these reforms reach early realization. While there may be differences of opinion over such provisions as compulsory license, there can be no dispute that the conduct of interferences and of litigation in the courts need radical changes.

The fundamental provisions of our present patent system are admirable, and are not excelled in any other country. But the method of administration might be much improved by taking from English and German practice their many points of excellence.

Department of Justice to Attack American Telephone and Telegraph Company.

It is announced that the Department of Justice will file suit within a few weeks for the dissolution of the American Telephone & Telegraph Company, charging it with the violation of the Sherman anti-trust act. The company will be charged with absorbing independent telephone and telegraph companies, and maintaining a virtual monopoly in the former field.

The American Telephone & Telegraph Company owns $405,359,400 par value of the $441,733,402 total stock of thirty-seven companies.

The company owns $12,047,700 of the Western Electric Company's $15,000,000 worth of stock. The company was organized under the laws of New York in 1885, with a capital of $100,000. In June, 1896, this was increased to $20,000,000; in 1898, to $25,000,000; in 1899, to $75,000,000; in 1900, to $100,000,000; in 1901, to $150,000,000; in 1903, to $250,000,000; in 1909, to $300,000,000, and in March, 1910, to $500,000,000.

B. E. Sunny, president of the Chicago Telephone Company, when interviewed with regard to the contemplated action, said that he had not heard of it, and added: "I can't understand how or why such an action should be contemplated. I know of nothing that has been done at any time by our company that could be construed as a violation of the Sherman law."

When asked if the Chicago Telephone Company had bought stock in independent or rival companies, he said: "No, we have not, nor to my knowledge have any of the officials connected with the company. It is a fact that from time to time we have bought a few small companies throughout the state, but they constitute a very small item and were bought simply for the purpose of extending service."

The American Telephone & Telegraph Company acquired a substantial interest in the Western Union Telegraph Company in 1909, and since then has operated very closely with the telegraph company. Since the co-ordination of the telephone and telegraph services the growth of both arms of the service has been very great, even compared with the phenomenal development which had been reached prior to that time. The results have been extremely beneficial to the public, and there has been no complaint of this feature being considered an injury to trade or commerce in any way. As a matter of fact, writers upon economics and business men in general have agreed that if there was any reason for a natural monopoly of any description the telephone and telegraph people would automatically fall under that class.

Visiting-Member Privileges With Foreign Electrical-Engineering Societies.

For some time past the Board of Directors of the American Institute of Electrical Engineers has desired to promote closer relations between the Institute and foreign electrical engineering societies. The advantage of a closer understanding was especially felt last year, when so many Institute members went abroad to attend the International Electrical Congress at Turin, and the meeting of the International Electrotechnical Commission. On receiving the report of Gano Dunn, who as president of the Institute headed its delegations to both of these meetings, the Board, feeling that it would not only promote mutually the convenience of visiting engineers both to this country and abroad, but would also increase the friendly relations which are constantly growing through the activities of the International Electrotechnical Commission and other similar agencies, passed the following resolution:

RESOLVED, that the President is authorized to communicate with certain leading foreign electrical engineering societies with respect to establishing mutual visiting-member privileges for a limited term, with the end in view of contributing to the convenience of our own members visiting foreign countries, and, in return, affording corresponding conveniences to members of foreign electrical-engineering societies visiting the United States, and of increasing the friendly relations between American and foreign engineers.

Accordingly a number of European electrical engineering societies were communicated with by President Dunn, and the following have cordially accepted the Institute's proposals to enter into reciprocal arrangements:

Institution of Electrical Engineers (Great Britain), Verband Deutscher Electrotechniker (Germany), Société Internationale des Électriciens (France), Associazione Elettrotechnica Italiana (Italy), Koninlijk Instituut van Ingenieurs (Holland), Association Suisse des Électriciens (Switzerland). The Svenska Teknologforeningen (Sweden) will take up the question at the meeting of its governing body in the fall.

The arrangements entitle members of the American Institute of Electrical Engineers while abroad to the privileges of members of the societies designated, for a period of three months, and foreign members visiting this country are entitled to the privileges of Institute membership for a like period.

To foreign engineers visiting this country it is proposed to give, upon presentation of proper credentials, letters of introduction to Institute members and to officers of manufacturing and operating companies; also to place at the disposal of visitors the facilities of the library, in which are a large number of books in foreign languages, and the reception, reading and writing rooms at Institute headquarters. Visitors may also have their mail received and forwarded.

There has been prepared for the use of Institute members while abroad a form of certificate to be signed by the secretary, which will serve as credentials from the Institute to foreign societies. A separate certificate is necessary for each foreign society.

New Publication Plan for N. E. L. A. Proceedings.

The executive committee of the National Electric Light Association has decided to make an important change in the manner of issuing the bound proceedings of the Association. The annual reports have become so bulky that it has been impossible to get the proceedings out without going into two or three thick volumes. The expense of this and the advance printing for the convention has increased so heavily that last year it amounted to nearly $30,000.

Under the new plan the proceedings will be divided into four parts—(1) general and executive; (2) technical and power transmission; (3) commercial; (4) accounting.

Member companies will receive all four parts, and sets will also be furnished complete to company sections. Individual members will be furnished free that part in which they are directly interested, and if any extra part is required it will be supplied at net cost.

Fort Worth Contractors and Workers Hold Meeting.

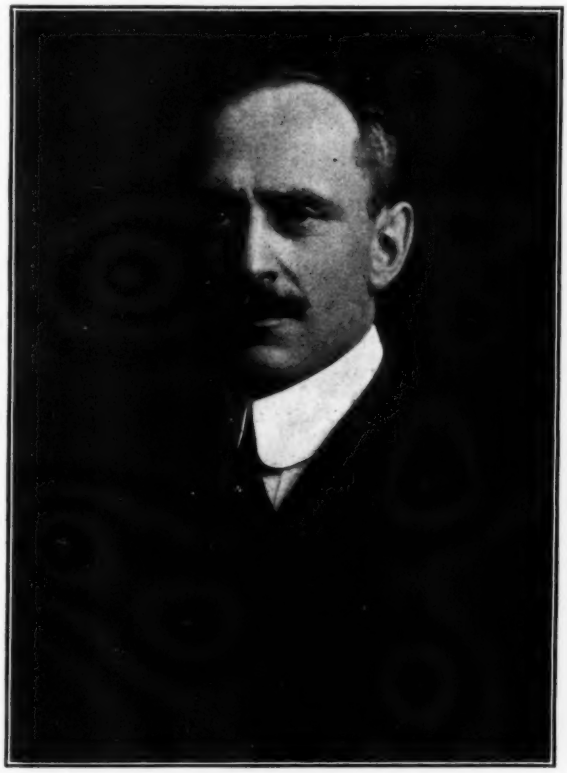
On August 22 the Fort Worth Electrical Contractors' Association gave a banquet to the Fort Worth local of the International Brotherhood of Electrical Workers. A. J. Anderson acted as toastmaster, and after extending a welcome to the members present called upon Charles Miller, president of the Contractors' Association. Mr. Miller made a brief address, and was followed by Frank Swor, district organizer for the International Brotherhood of Electrical Workers.

Z. C. Adams, city electrical inspector, was the next speaker, and was followed by C. W. Woodman, E. H. Keller, Howard Greer and R. S. Wakefield, manager of the Wesco Supply Company. Mr. Wakefield is also president of the Fort Worth Electrical Club and a Jovian senator. The meeting closed with responses from E. A. Shotts, F. W. Broiles and W. L. Kelsey.

R. S. Orr.

When the convention of the Pennsylvania Electric Association is brought to a close on Friday, September 6, the Association, which is a state section of the National Electric Light Association, will have completed one of the most successful years in the history of the organization. The elaborate program of entertainment and business for the forthcoming meeting, which appears elsewhere on this page, indicates but little of the hard and earnest effort that R. S. Orr, president of the Association, has extended to make his administration a noteworthy one.

Mr. Orr was elected to the presidency at the annual meeting held at Conneaut Lake, Pa., last September and thus became the official head of an organization that he was instrumental in founding and that he has taken an active interest in since its inception.



R. S. Orr,
President, Pennsylvania Electric Association.

R. S. Orr was born October 14, 1867, in Clarion County, Pa., and was educated in the public schools, Washington and Jefferson Academy, and Washington and Jefferson College, receiving the degree of B. A. from the latter institution in 1891. For two years after his graduation, Mr. Orr taught in the Washington and Jefferson Academy, leaving there to accept the position of principal of the Ninth Ward public schools of Allegheny.

When, in February of 1904, Mr. Orr was offered the position of general contracting agent of the Allegheny County Light Company, of Pittsburgh, he decided to give up teaching as a profession and enter the central-station field. The wisdom of this move is shown in the enviable record Mr. Orr has made since becoming connected with the Pittsburgh company. So effective and aggressive was his work that within a short time he was made acting superintendent, and within less than a year general superintendent, a position which he has since filled with credit to himself and his company. Mr. Orr effected many improvements in the service and is the inventor of a method of re-inforcing decayed wood with concrete, used generally by telephone, telegraph, railway and lighting companies throughout the country.

Mr. Orr has always taken an active part in various technical and engineering societies and has contributed to the papers and discussions of the organizations to which he belongs. He is a member of the National Electric Light Association, the Engineers' Society of Western Pennsylvania, American Electrochemical Society, and an associate member of the American Institute of Electrical Engineers. He is also a member of the University Club of Pittsburgh, Pittsburgh Athletic Club, Board of Allegheny School Controllers, a trustee of St. John's General Hospital and a director of the Ohio Valley Bank.

Program of Pennsylvania Electric Association.

As previously announced the fifth annual convention of the Pennsylvania Electric Association will be held at Bedford Springs, Pa., September 3, 4, 5 and 6. Headquarters will be at the Bedford Springs Hotel, the meetings being held in the ball room. The advance registration indicates that this will be one of the most successful meetings of the organization and the officers and various committees are leaving nothing undone to make the convention one of profit and enjoyment.

The program of the business sessions as finally arranged is as follows:

Wednesday, 9 a. m.—Address by the President. Report of Executive Committee. Report of the Secretary and Treasurer. Report of the Committee on By-Laws. Report of the Lamp Committee. Report of the Committee on Overhead Line Construction. Appointment of Nominating Committee.

Thursday, 9 a. m.—Paper and demonstration of the Schafer Prone Pressure Method of Resuscitation from Electric Shock, by C. A. Lauffer, Pittsburgh. Address by Frank M. Tait, Dayton. Address by T. C. Martin, New York. Paper, "Dollars and Factors," by C. J. Russell, Philadelphia. Paper, "The Wiring of Already-Built Houses," by Messrs. McKirdy and Wood, Pittsburgh. Paper, "Automatic Feeder Regulators for Out-of-Door service as Applied to Single-Phase Lighting Circuits," by F. W. Shackelford, Schenectady.

Thursday, 2 p. m.—Executive Session.

Friday, 9 a. m.—Paper, "Welfare Work," by B. F. Day, Philadelphia. Paper, "Purchased Power—Its Advantages Versus Its Cost," by A. E. Rickards, Pittsburgh. Paper, "Power-Factor—Its Effect on Operation and a Means for Its Improvement," by F. N. Jewett, St. Louis. Report of Nominating Committee. Election of Officers. Adjournment.

Elaborate entertainment features have been arranged for, these including a reception on Tuesday evening, golf tournament, ball game and entertainment Wednesday, golf and convention dinner Thursday and golf and musicale Friday.

Electric Ceiling Fans Popular in the Orient.

The use of the time-honored "punkah" or overhead fan hung from a ceiling and agitated by a coolie pulling it from side to side, which has been characteristic of the East, is gradually disappearing, says an American consular agent in Hongkong, China. Its place is being taken by the electric ceiling fan. Few new buildings in Hongkong, for example, are fitted with punkahs, but all are wired for electricity with special reference to the use of ceiling fans.

Copper Production in Japan.

The Belgian consul at Yokohama reports that the total production of copper in Japan in 1911 amounted to 51,708 tons, valued at $13,200,000, being an increase of 2,562 tons over the production in 1910, and an increase of 13,734 tons as compared with 1909.

Electric Lighting Introduced in Arabia.

That Arabia is progressing is shown by the two following items. The installation of a 500-lamp electric lighting plant in the palace of the Sultan of Oman, at Maskat, Arabia, has just been completed by N. S. Bayanker. This is the first instance of the operation of any sort of electric machinery in this country. Mr. Bayanker has also secured permission to operate a commercial lighting and power plant and will proceed to erect the same at once, his intention being to use two 30-kilowatt dynamos capable of supplying current for 6,000 lamps. One set of machines will be run at night and the other in the day, principally for the purpose of driving fans which, on account of the great heat and the difficulty of securing energetic punkah pullers, are much needed. Power will be furnished by oil engines and direct current will be used.

One of the recent purchases made at Cairo, Egypt, by the Sultan of Lahej, is a dynamo for generating light in his palace at Lahej, an Arabian town 18 miles northwest of Aden. A large number of electric lamps, wires, and other fittings have also been bought.

Searchlights and Wireless At Sea.

The question of the use of searchlights on large passenger vessels is one of the many points covered in the report of the English Merchant Shipping Advisory Committee. While it is recognized that such lights would be of value in picking up an unlighted buoy, rock, land, iceberg, or icefield, or in passing through a canal, or for salvage purposes, there would be many disadvantages which the committee describes thus: (1) dazzling the observers on board the ship making use of the lights, especially if the lights are badly placed; (2) general danger to navigation owing to the blinding effect on those on board other vessels and to the possibility of the navigation lights of the vessel exhibiting the searchlight being obscured; (3) temptation to make land, buoys, etc., by placing too much reliance on picking up the marks by means of the searchlight; (4) false security when in the vicinity of ice or other dangers; (5) the danger of searchlights being mistaken for powerful electric lights from lighthouses, especially in thick or hazy weather, and of searchlights having the effect of screening shore lights from passing vessels. In short, the Committee considers that as the disadvantages appear to outweigh the advantages, the use of searchlights in the mercantile marine is not to be recommended.

A subcommittee went exhaustively into the question of wireless telegraphy and it has reported advising that all foreign-going ships, whether British or foreign, if carrying 50 or more persons (including crew) from or to the United Kingdom, be equipped with wireless apparatus. Further, if freight vessels are required by Parliament to carry wireless the owners should be reimbursed from public funds. In foreign trade, apparatus with a normal day range of 100 miles, over sea would be effective for life-saving. The subcommittee advises among other things, that the wireless installation be supplemented by batteries (dry or secondary) or other motive power to keep the apparatus capable of working for four hours after the ship's engines have failed. All foreign-going vessels should carry one fully qualified operator and sufficient assistance to ensure a constant watch for distress or danger signals when the said operator is absent.

Result of Safety-Lamp Competition.

The judges in the English $5,000 prize competition for a safe and efficient type of miners' electric lamp have issued their report.

Inventors, both British and foreign, submitted 195 different lamps, and acting under the powers granted to them, the judges (Charles Rhodes, representing mining interests, and Charles H. Merz, representing electrical) have divided the amount among a number of competitors. The first prize to the value of $3,000 is awarded to the C. E. A. G. lamp sent in by F. Farber, of Dortmund, Germany. It is understood that some 20,000 of these lamps are in use in collieries in different European countries. Eight prizes of $250 each are awarded to other competitors, English and continental. The conditions which were imposed upon competitors were as follows: Each lamp to be (1) of sound mechanical construction, so as to withstand rough usage; (2) of simple construction and easy to maintain in good order and repair; (3) so constructed as to render impossible the ignition of inflammable gas either within or without the lamp; (4) the lamp battery was to be so constructed that any liquid it might contain could not be spilled with the lamp in use; (5) the lamp was to be so constructed as not to be liable to deterioration by corrosion as the result of the action of the electrolyte; (6) it was to be effectively blocked; (7) to be capable of giving an amount of light not less than two candlepower continuously for ten hours; and (8) the light was to be well distributed outside the lamp. Regard was also to be paid to first cost, cost of maintenance, convenience in handling, and weight of lamp charged and ready for use

New England Convention.

The fourth annual convention of the New England Section of the National Electric Light Association will be held in Mechanics Building, Boston, Mass., October 15, 16 and 17, 1912. This convention is to be held during the 1912 Boston Electric Show and in the same building, and it is planned to invite the entire membership of the National Electric Light Association to this convention. This will give those who could not attend the convention in Seattle last June a fine opportunity to attend a big convention this year and at the same time visit the Electric Show.

There will be seven interesting papers presented and discussed, besides many other features of interest.

Ornamental Street Lighting System for Peoria, Ill.

Eighty-six ornamental street-lighting standards will be contracted for, for installation at Peoria, Ill. These will be cast-iron standards, with underground system of wiring. Each standard will be equipped with 16-inch ball and 100-watt tungsten lamp. The posts will be placed 100 feet apart in the Upland Addition, on Institute Place, Columbia Terrace and Parkside Drive. Some of the posts will also be placed on the Bradley Park property. The property owners will pay for the cost of installation, and the maintenance cost is to be paid for by the city and the park.

New Hydroelectric Project in Mexico.

A 99-year concession has been granted by the Mexican Government to D. J. Spillane, of San Luis Potosi, to take 50,000 liters per second from the Santa Maria River and 25,000 liters per second from the Gallinas River for power purposes. The works will be built near the junction of the two rivers, where the fall is about 348 feet and at normal flow is capable of developing 40,000 horsepower. There are excellent opportunities for increasing this by storage reservoirs to permit the normal development of over 100,000 horsepower. It is understood that a company has been formed in the United States which has purchased the concession from Mr. Spillane, together with some 25,000 acres of land.

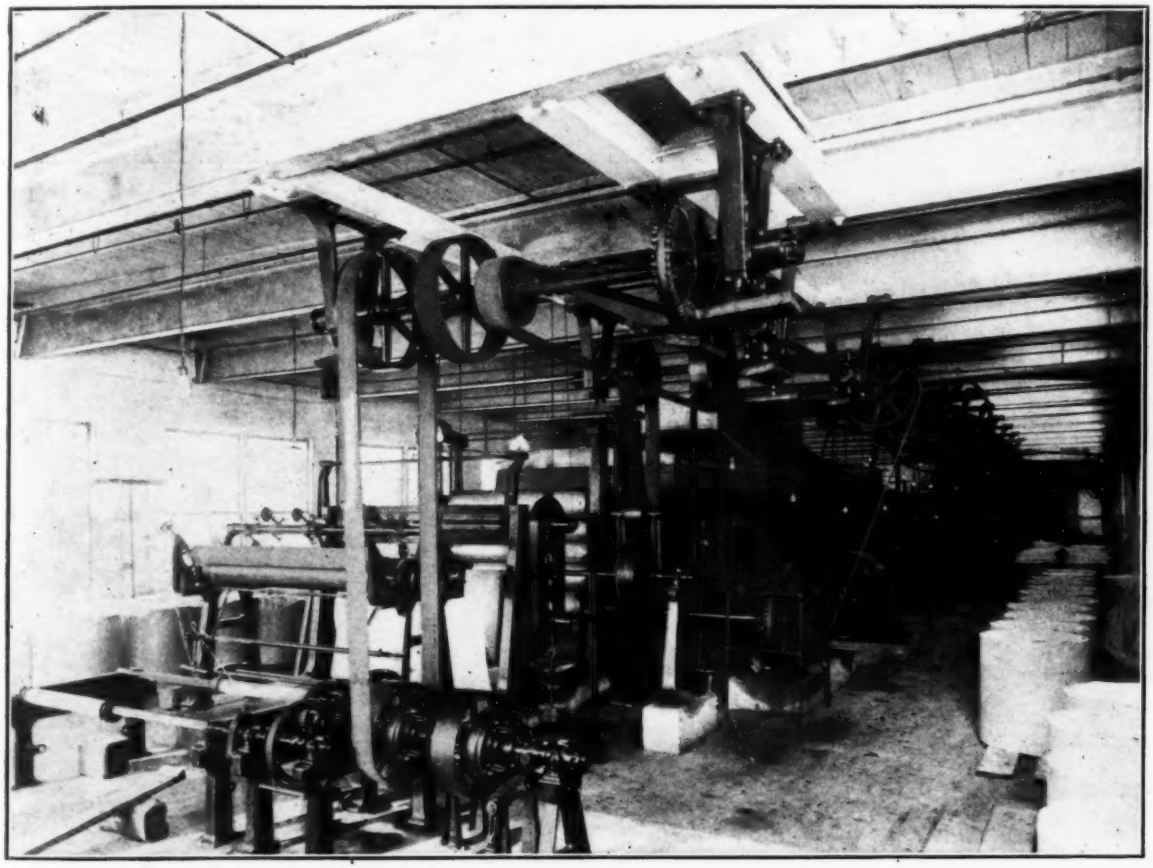
Old Time Telegraphers' Reunion.

The next annual reunion of the Old Time Telegraphers' and Historical Association and of the Society of the United States Military Telegraph Corps will be held at Jacksonville, Fla., on October 22, 23 and 24. F. J. Scherrer, New York City, is secretary of the Association.

Electricity in Paper Mills.

Increased quality and quantity of production is obtained by the use of electric drive in paper mills, due to the fact that each machine is operated and each kind of paper finished at the correct speed. Characteristics of paper-making machines and motors best suited for each individual drive are discussed in this article.

No line of improvement in paper-mill equipment will contribute more to the securing of low cost of production and high-grade output than the adoption of the electric system of power transmission. The scheme of power transmission which has prevailed in paper mills has a parallel in that to be met with in any other factory of equal or greater size not already equipped with electric motors. A distinguishing difference, however, between the paper mill and the other types of factories is found in the fact that in possibly no other industrial establishment is the percentage of losses due to an inefficient system of power transmission so great as in the paper mill: and, as a consequence, in no other type of industrial establishment is the per cent of saving resulting from electrical equipment so large.



Motor-Driven Paper Machines.

While the innumerable advantages of electric drive for paper mills are generally appreciated by mill owners, the economy of this method of drive on the paper machine itself, is sometimes questioned. It is contended that as long as it is necessary to use steam for drying it would be preferable to drive the machines by engines and use the exhaust for drying. However, it is being convincingly demonstrated that the use of live steam for drying is to be preferred, as its use permits of maintaining a constant temperature on the dryers, resulting in a uniform sheet of paper of high finish, a condition which cannot be easily secured by exhaust steam on account of the varying pressure in the line. Occasionally the exhaust frequently drops to so low a temperature that it is practically water and of little value for drying.

Considered from the standpoint of the central station, the paper-making industry offers a very large and profitable field for the sale of energy. While it is impossible, in most cases, to supply the total amount of power used the majority of mills can purchase, at a considerable saving, an appreciable proportion of their power whether the plant used either steam or waterpower. In a visit to several typical mills in the Wisconsin district, where there is an abundance of water power, the average amount of power furnished by the local central stations was 400 horsepower or over, in each case. Paper mills require enormous amounts of power and the percentage which the central station can supply depends entirely upon local conditions and the knowledge of the central-station engineer of the mechanical problems to be met.

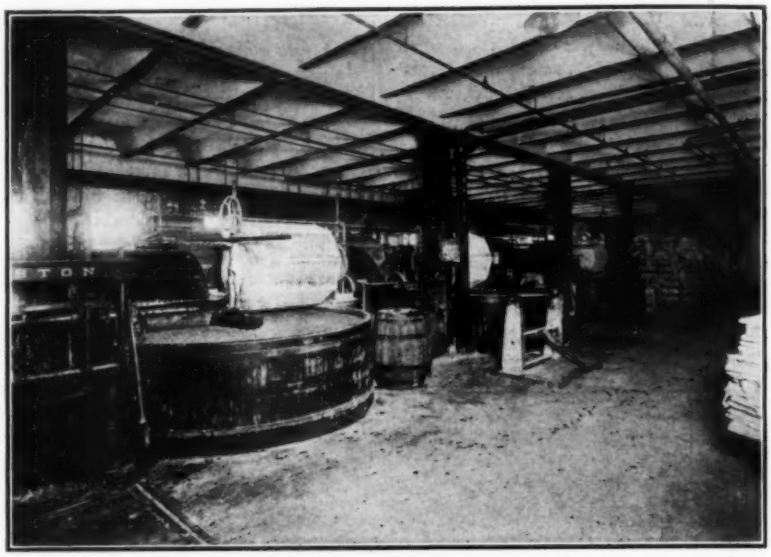
The mose important consideration in the equipping of a paper mill for motor drive is the paper machine itself.

as the successful operation of the auxiliary apparatus is of no avail if there is trouble at this point. Paper as it leaves the machine does not, for many purposes, have a sufficiently high glaze and it is therefore necessary for it to undergo some further process known as calendering. This may be done in one of the three ways: first, the whole roll may be calendered by passing the paper through a "super or webb calender," second, the paper may be cut in sheets and these sheets calendered in a "sheet calender;" third, the paper may be cut in sheets and calendered in a "plater." The method used depends on the kind of paper and the kind of finish desired. All "loft" or air-dried papers are finished either in a sheet calender or a plater as the paper must be cut into sheets before drying. These papers are usually of the higher grades.

Considerable interesting data on motor drive for the three types of calenders mentioned, were presented in a paper by E. C. Morse before a recent meeting of the American Institute of Electrical Engineers, from which paper the following notes are derived.

Super Calenders.—A super calender consists of a stack of rolls carried in upright housings, each roll having its own bearings which are so constructed that they are free to move vertically. Power is usually applied to the lowest roll (occasionally to the third) and the other rolls are driven by friction from this one. Oil for lubrication is supplied to the top journals and is carried down through the other bearings by gravity. The top and bottom roll and the small or intermediate rolls are nearly always steel, the other rolls may be either steel, chilled iron, paper or cotton, depending on the kind of paper and finish desired. A system of levers with weights is used to apply pressure to the top roll in order that there will be proper pressure on the paper. The number of rolls is nearly always odd and may be three, five, seven, or nine, usually seven or nine. The diameter of the bottom roll varies from 18 inches to 24 inches, the intermediate from 10 inches to 16 inches, the cotton or paper rolls from 14 inches to 20 inches. Calenders are built varying in width from 36 inches to 125 inches.

One end of paper is taken over the top of the calender and then passed back and forth between the rolls to the bottom of the stack and then to the winding roll. In order to pass this paper through between the rolls, which process is known as "threading in," it is necessary to operate the rolls at a slow speed and it is very important that this speed be constant. This speed varies in different mills from 20 feet per minute. As soon as the paper is "threaded in" and started on the winding roll, the calender must be speeded up and will then operate at a speed between 400 feet to 800 feet per minute, depending on the method of drive, the operator, and the kind of paper calendered. It is therefore necessary to provide at least two speeds on each stack, one a slow speed and the other a high speed, regardless of the method of supplying power. It is very important that the acceleration be smooth from the slow speed to the high speed in order not to break the paper and cause the consequent loss of production. It is also very advisable to have a method of slowing down, when a weak or torn place in the paper appears, and of smoothly accelerating to highest speed again. It is convenient to be able to stop the calender from other places than at the operators' usual stand, in case of emergency.

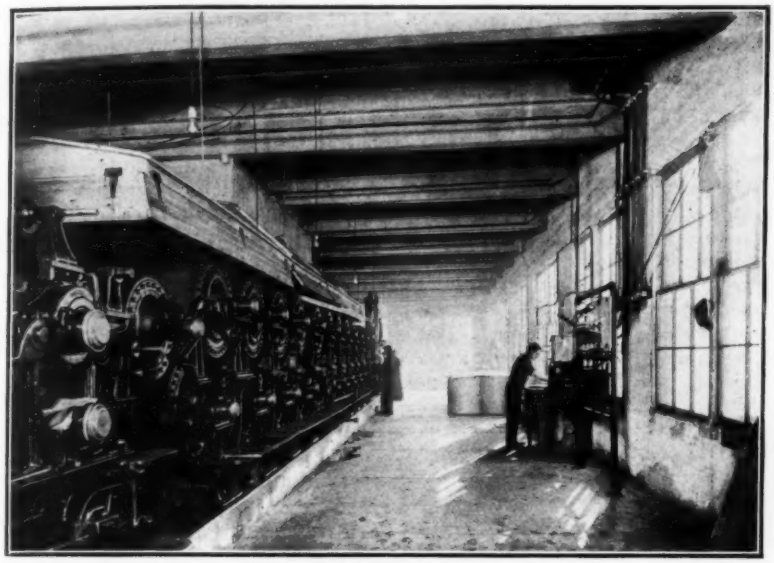


Group of Motor-Driven Beaters.

Abroad and in one or two cases in this country, individual variable-speed engines are used to drive calenders. As no steam is required ordinarily around a calender this engine drive means long live and exhaust-steam lines. This drive requires space in the basement and an engineer in attend-

Motor Direct-Connected to Jordan.

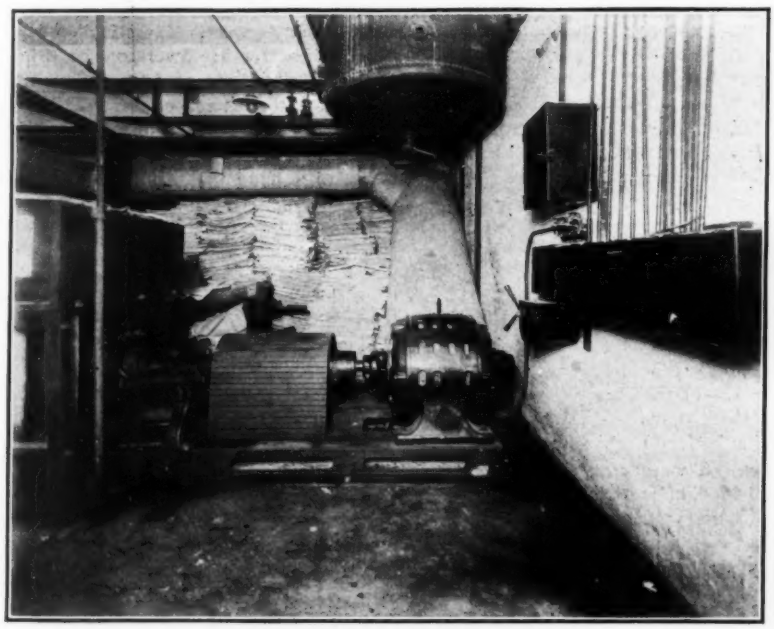
ance. A belt drive through floor is used with the attendant grease and dirt which is always present around a reciprocating engine. A two-cylinder engine must be used and even then a uniform torque is not obtained. This type of drive does not meet with favor among American manufacturers.



Motor-Driven Paper Machine. Control Board to Right.

Two Motor Drive.—The most natural step, when motors were applied to calenders, was to belt motors to the old mechanism which was used when the calender was belted to the line shaft. It was at once seen that a simpler, more compact arrangement could be made, as well as the belts eliminated, if the motors were mounted on same base with the clutches and gears, and geared to the driving mechanism.

It is now a simple matter to make the large motor a variable-speed motor and obtain smooth acceleration from slow to high speed. This type of motor makes it possible to gear the calender so that the maximum speed will be the maximum at which it is possible to finish any of the paper and the calender can easily be slowed down to accommodate weaker papers or for a different finish.



Motor Direct-Connected to Jordan Engine.

For the small motor a 7.5-horsepower 850 revolutions per minute squirrel-cage type of motor is used, which may be provided with an induction-type starter, or preferably a small oil switch mounted close to the controller for large motor. For the large motor a wound-secondary type is nearly always used and a full load speed of 495 or 580 revolutions per minute is required in order to keep the pitch-line speed and size of the gears within reasonable limits. This motor is controlled from a drum controller, with external resistance, usually of any speed, as low as 50 per cent of the maximum. Occasionally, the resistance is designed for only three- or five-minute service on the slow speeds. In addition, an automatic oil circuit-breaker should be installed to protect the large motor and also control circuit to small motor. This breaker should be equipped with an inverse-time-element relay so that the momentary peak demand for power on accelerating will not trip the breaker.

One of the most satisfactory controls which has yet been designed for a calender drive consists of a panel on which is mounted a set of solenoid-operated switches for main circuit, a circuit-breaker with inverse-time-element relay and an ammeter for check on power consumed.

The motor end of a direct-current drive is the same as with alternating-current with the exception that in some cases part of the speed control is obtained by varying field strength of the motor. The control is worked out in the same manner as before; in some instances the drum controller is replaced by one of a face-plate type. Sometimes a master controller only is used, which controls magnetic switches for handling the current. One advantage with direct current is the fact that dynamic braking can be obtained automatically and the calender stopped very quickly.

Two Motors Replaced by One.—It is possible to do away with the small motor used in a two-motor drive and by means of gearing and clutches to operate the calender at the threading-in speed from the large motor.

This drive resembles the two-motor drive, except by means of gearing and a clutch, the large motor is made to do the work previously done by the small motor. The same type of motor and control is used as before and the same facts regarding flywheel effect and braking are true. The calender is stopped by cutting the power off the motor. If the clutch is thrown out then there is only the flywheel of the calender alone as in the belt drive. This type of drive so far as is known has never been used with direct current but could be if desired.

One Motor Direct Geared.—In this per minute to a maximum of 100 feet

method of drive there is only one large motor direct-geared or belted to the driving roll. It is therefore necessary to obtain the threading-in speed or a speed one-eighth to one-thirteenth of the maximum by reducing the speed of the motor by inserting resistance. This drive eliminates all clutches, nearly all the gears and makes mechanically a very compact and simple drive.

In this drive the one large motor of the wound-rotor type is geared or belted direct to the driving roll. It is, therefore, necessary to decrease the speed of this motor, by inserting resistance in secondary to one-eight or one-twelfth the maximum speed in order to obtain the proper "threading-in" speed. It is impossible to obtain a stable "threading-in" speed in this manner, owing to the well-known characteristics of an alternating-current wound-rotor variable-speed motor. If the calender is running without paper at the proper speed and paper is fed in, the friction increases and if this increase amounts to approximately eight and one-third per cent the motor will stop. With some cardboard this increase in friction has been found to be as high as 60 per cent. It is impossible, in nearly every case, to complete the "threading-in" without changing the controller setting, which may mean a third man on the calender. After the paper is "threaded in" the motor operates like any other variable-speed motor. The control which should be used with this drive is the one using solenoid switches described under "Two-Motor Drive." The controller must be supplied with a large amount of resistance in order to obtain the very slow speed. The flywheel effect and braking conditions are as in the two motor drive.

If a direct-current motor is used direct geared, the conditions are not quite so bad. A direct-current motor giving a 3:1 or a 4:1 reduction in speed from the maximum by field control should be used. The power input of this motor is proportional to the load within its speed range and is not constant as in the case of the alternating-current motor. It is now necessary to reduce the speed from the full field speed, or one-quarter the maximum to only one-half of one-third in order to obtain a "threading-in" of one-eighth to one-twelfth the maximum speed. Using a commutating pole motor of good inherent regulating qualities, a fairly stable speed is obtained and it will take 33 per cent increase in friction to stop motor instead of eight and one-third per cent as in the alternating-current motor. Therefore, with a 30 per cent increase in friction in "threading in" one would not expect to stop the motor. With paper this increase is much smaller and this speed change would not be troublesome. Another feature is that dynamic braking can be used and quick stopping assured.

Power Requirements.—The power consumed by a calender is entirely used in overcoming friction, therefore, a calender requires (within limits) a constant torque. It has further been found, from tests, that with most grades of paper, only 15 to 20 per cent of the power consumed is required by the paper itself, and 80 to 85 per cent of the power is consumed in overcoming the friction of the machine. Therefore, to drive a given calender at various speeds, a motor or engine is required that will give constant torque rather than constant horsepower over the range of speed desired.

Slow-Speed Power Requirements.—As previously stated means must be provided to obtain a slow or "threading-in" speed, approximately one-eighth to one-thirteenth the maximum speed of the calender, in order that the feeding in of the paper may be done as easily and quickly as possible. This speed should remain practically constant with the change in torque from the calender alone without weights, to the calender with paper completely "threaded in." This increase in torque varies from 10 to 75 per cent, depending on the kind of paper or cardboard being calendered. Many slow-speed drives have been tested and the maximum horsepower required by the motor at 50 to 60 feet per minute on the paper has never exceeded five to six horsepower, regardless of the size of the calender.

High-Speed Power Requirements.—When we come to determine the power required by a calender when calendering paper, there are many points to be considered. These are listed in order of their relative importance, and then each taken up in detail: (a) Material, size, number and condition of rolls; (b) number of "nips" or passes of paper; (c) type bearings; (d) kind of stock; (e) pressure on rolls; (f) width of stock or rolls; (g) surface speed of rolls in feet per minute.

(a) The varying of the power with the kind of rolls is closely interlinked with the varying power due to different pressures applied. It is known that the power varies according to hardness of the roll, therefore steel or chilled iron requires the minimum power, then comes paper and then cotton. This variation is probably only a few per cent in most cases. A temporary increase of 20 to 25 per cent in the power may be required by a calender when starting up with rolls and bearings cold; this will not usually last more than 15 to 30 minutes and can be taken care of by overload capacity of the drive. It has also been found that a calender takes a little less power as the size of rolls are increased, due to the wedging effect being less.

(b) Even though a seven or nine-roll stack is installed, it may be found possible to obtain the finish desired without passing the paper between each pair of rolls. Each pass is known to the paper maker as a "nip." The more "nips" taken, the larger the power and this increase varies from nearly zero with hard paper to 10 per cent with heavy cardboard for each "nip."

(c) Practically all calenders are equipped with plain bearings although roller bearings have been used in a few cases. It is claimed that roller bearings reduce the bearing friction about 30 per cent but the first cost and maintenance is probably higher than for plain bearings. It is also essential to keep the bearings well lubricated.

(d) The amount of power required by a calender will vary according to the thickness of the stock being calendered. This stock varies from the thin book paper to heavy cardboard. The power required for the heavier grades of board may be from 25 to 30 per cent more than for the ordinary weights of book paper. It is not customary to use as much pressure on the heavy cardboards as on the thinner papers. The power requirements for different grades of papers of approximately the same thickness do not vary to any extent. There is also very little difference in power consumed between plain and coated papers.

(e) As the power consumed by the rolls alone of a calender is used in overcoming rolling friction, it is correct to assume that it will increase in proportion to the pressure. The total load circuits not only of the friction of the rolls, but also of the roll bearings and driving mechanism; which friction will not increase directly with the pressure on the rolls. For all practical purposes, however, as regards the motor sizes, it is safe to assume that the torque will vary directly with the pressure applied to the rolls. Tests made in Germany show that increasing the pressure 3.43 times increases the power 2.74 to 2.78 times. Another variable that now enters is whether the rolls are steel, chilled iron, paper or cotton. The friction of the last mentioned increases somewhat faster than the others as pressure is applied.

(f) Approximately 80 to 85 per cent of the power used in a calender is consumed in overcoming the roll and roll bearing friction except in the case of cardboard. Of this, the amount consumed by the bearings is a very small percentage. The friction of the rolls

(Continued on page 397.)

Pulp and Paper Mills—Data Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected.

Marinette & Menominee Paper Company, Marinette, Wis. This plant produces about 17 tons of paper per day of 24 hours. Wrapping paper of various grades is the principal product. Two paper rolls and calenders are operated by steam engines. Some water power is also used.

Total connected horsepower, 400. Total number of motors installed 5. Average kilowatt-hours per month, 152,145.

Kilowatt-hour consumption for 5 months: February, 172,850; March, 147,860; April, 144,730; May, 147,640; June, 147,640.

Load-factor, 69.7 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	200	495	Driving 16 feet of shafting to which four 1,500-pound beaters are connected. Beaters are made by the Appleton Machine Company.
1	75	800	Direct-connected to one 1,500-pound capacity Jordan, manufactured by the Appleton Machine Company.
1	50	850	Belted direct to a 1,200-pound capacity Jordan, manufactured by the Appleton Machine Company.
1	25	580	Belted to two revolving screens, 24 inches diameter.
1	50	850	Belted to shafting driving three wet sulphite machines and two 5-inch centrifugal pumps.

Energy is supplied by the Menominee & Marinette Light & Traction Company.

Northern Paper Mills, Green Bay, Wis. This plant specializes in the manufacture of various grades of tissue paper and has an average output of 20 tons of paper per day. Central-station power is supplemented by steam and water power. Combination drive. Running hours per day, 24.

Total connected horsepower, 490.5. Total number of motors installed, 14. Average kilowatt-hours per month, 160,542.

Kilowatt-hour consumption for 7 months: January, 181,900; February, 180,300; March, 133,300; April, 152,700; May, 168,800; June, 130,300; July, 176,500.

Load factor, 60 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 25 cycles, 440 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	125	360	Belted to six-hanger shaft driving four 1,000-pound beaters. Appleton Machine Company.
1	20	440	Belted direct to 6-inch centrifugal pump.
2	25	350	Each direct-connected to a 1,500-pound capacity Jordan.
1	120	710	Belted to a line shaft driving five re-winding rolls and one spiral-tube machine.
1	3	1,420	Belted direct to one Sheridan 36-inch paper cutter.
3	10	710	Each direct-connected to a three-ton-capacity freight elevator.
1	125	470	Belted to shafting driving five beaters, each of 700 pounds capacity.
1	20	440	Direct-connected to a 6-inch vertical pump.
1	50	470	Belted to shafting driving one 60-inch blower for heating system; three 1,200-pound washers; one agitator on 1,200-pound stuff chest; and one stuff pump, capacity one ton per hour.

Energy is supplied by the Green Bay Gas & Electric Company.

Paper and board plant manufacturing 12 tons of heavy paper and board per 24-hour day. A 60-inch cylinder paper machine is driven by a 75-horsepower steam engine.

Total connected horsepower, 75. One motor. Average kilowatt-hours per month, 5,254.

Kilowatt-hour consumption for 12 months: January, 320; February, 1,060; March, 1,920; April, 1,060; May, 160; June, 580; July, 1,520; August, 10,100; September, 2,350; October, 13,340; November, 27,430; December, 3,210.

Load-factor, 12 per cent.

MOTOR INSTALLATION.

The following is a list of the machines driven. The motor is a squirrel-cage induction machine. The supply source is three-phase, 60 cycles, 440 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	75	850	Belted to a shaft and 50 feet of countershafting driving three Jones 1,000-pound beaters; two E. D. Jones Jordans; one 4,000-pound freight elevator; and two stuff pumps, 10 feet lift. The motor is supplemented by 200 horsepower in waterpower.

Pulp and Paper Mills—Data Sheet No. 2.

Pulp and paper mill, located in Wisconsin, manufacturing various grades of paper. The average output of the plant is 16 tons of paper per 24-hour day. Two paper machines and a super-calender are driven by a steam engine supplied by four 350-horsepower boilers. A total of 1,000 horsepower in waterwheels is also installed.

Total connected horsepower, 449.5. Total number of motors installed, 12. Average kilowatt-hours per month, 38,766.

Kilowatt-hour consumption for 6 months: July, 66,200; August, 37,200; September, 46,000; October, 29,300; November, 12,100; December, 41,800.

Load-factor, 14 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 440 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	40	580	Belted to a Taylor & Stiles No. 10 rag cutter.
2	50	580	Each driving through a 5-inch Morse chain, one E. D. Jones 2,000-pound rag washer.
5	40	580	Each driving through a 5-inch Morse chain, one E. D. Jones 1,100-pound beater.
2	75	360	Each direct-connected to an E. D. Jones Jordan.
1	2	1700	Belted to a Green economizer.
1	7.5	840	Coupled to a Duplex 5-inch air pump.

Paper and board plant manufacturing a four-ply cardboard. The board is cut in sheets and shipped in bundles of 50 pounds. There are 25 men employed working in two shifts of 12 hours each. The average output is 15 tons of board per day.

Total connected horsepower, 265.5. Total number of motors installed, 7. Average kilowatt-hours per month, 87,200.

Kilowatt-hour consumption for 12 months: June, 100,700; July, 77,100; August, 72,200; September, 50,200; October, 91,700; November, 105,700; December, 98,500; January, 101,000; February, 79,000; March, 101,300; April, 72,400; May, 96,600.

Load-factor, 64.5 per cent.

The electrical energy consumption per ton of board manufactured is 242 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors with their respective drives. The supply source is three-phase, 60 cycles, 440 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	40	850	Slip-ring motor belted to both constant and variable speed lines of a Moore & White 62-inch, four-cylinder board machine. (Motor has double-flange pulley and outboard bearing). Constant speed line: 25-foot shaft (five hangers) and 36 feet of countershafting (10 hangers). Connected load: One Moore & White plate screen (24-inch by 6-inch pulley on cam shaft, at 180 revolutions per minute) and a worm gear to the drag on screen; one stuff chest (agitator 9 revolutions per minute); two Black & Clawson single-acting 15-inch by 14-inch stuff pumps, 36 strokes per minute; four size 2½ centrifugal pumps, 5-inch suction, 3-inch discharge, each draws the white water from one cylinder of the machine and has a 12-inch by 6-inch pulley, 440 revolutions per minute; two felt beaters, 10-inch by 4.5-inch pulleys, at 354 revolutions per minute. Variable speed line: Motor is belted to a 32-inch by 10-inch pulley on a Reeves transmission (4 to 1 range). Average paper speed 30 feet per minute. An 18-inch by 12-inch pulley on this transmission belts to a 25-foot shaft (five hangers) which drives the following: Three pair squeeze rolls; first press rolls (14-inch diameter); second press rolls (12-inch diameter), 31 36-inch diameter dryers (driven in four sections), one 3-roll stack of calenders, one glue roll and paster; three 28-inch diameter dryers; one 5-roll stack of calenders; one Moore & White slitter and cutter.
1	50	850	Belted to either of two J. H. Horne & Sons' jordans, capacity one ton per hour; motor pulley 14 inches by 15 inches, jordan pulley 30 inches by 16 inches.
1	3	1,120	Back-geared and belted to a Black & Clawson 8-inch by 14-inch, single-acting stuff pump, 42 strokes per minute.
1	7.5	1,700	Belted to a Heald Sisco & Company No. 3 centrifugal pump, 620 revolutions per minute, 5-inch suction, 3.5-inch discharge. Approximately 20-foot total head. Pumps fresh water to storage tanks.
1	10	1,120	Belted to a Bagley & Sewell 5-inch centrifugal pump, 560 revolutions per minute. Total head 25 feet. Pumps waste water from the machine.
1	150	690	Belted to a 30-foot shaft driving two Downington 600-pound beaters, 36-inch by 42-inch rolls, 36-inch by 12-inch pulley, 240 revolutions per minute; one 1,200-pound and one 1,000-pound Downington beater, 48-inch by 48-inch rolls and 66-inch by 16-inch pulleys, 170 revolutions per minute on each.
1	5	1,700	Belted to a 64-ampere, 125-volt, 800 revolutions per minute, direct-current lighting generator.

varies directly as the length of contact, therefore with any given design of calender on the same grade and same speed of paper, the power required will vary almost directly with the width of stack, or the active length of roll face.

(g) The power required by any given stack with same width and grade of paper will vary directly with the speed at which the paper is calendered, assuming same pressure at all speeds. This must be true if a calender is considered as a friction or constant torque machine.

Two Germans found from tests which were recently published that the power required at full speed was 1.95 times power required at 50 per cent speed, while the amount of paper turned out was 1.75 times without weights and 1.81 times with weights. The increase of pressure reduces slippage between rolls and paper as might be expected.

Power Required by Cardboard.—The power used when cardboard is calendered depends largely on the personal element of the mill and on the condition of the stock as it comes to the calender. For a slow speed of about 60 feet per minute a 10-horsepower motor is required, while the power requirements for high speed should be studied for each particular situation, inasmuch as the power required may easily be 25 to 30 per cent more than for the same calender if calendering paper. In many cases, however, very light pressure is used on the rolls. The total load on the motor will be about the same as for paper with heavy pressure on the rolls.

Motor-Driven Jordans.—For the operation of Jordan engines by motors a highly efficient and compact equipment has been designed. This consists of a regular wound-rotor induction motor with self-contained starting resistance, mounted on a sliding base and direct-coupled to the Jordan shaft. In order to permit the adjustment of the Jordan without affecting the efficiency of the motor, a shaft is run under the Jordan and connected at one end to the motor base, the other end being geared to the adjusting hand-wheel; thus any change in the adjustment of the Jordan may at once be compensated for by the movement of the motor on the sliding base. In this way there is no displacement of the rotor with respect to the field, as in some methods of motor-driven Jordans, and the motor will therefore operate under normal conditions at all adjustments of the Jordan.

As a heavy starting torque is sometimes required the type of motor chosen for this service will give approximately 150 per cent of full-load torque at starting.

Washers, agitators, beaters, grinders and other machines commonly found in paper mills present no especial difficulty in conversion to electric drive. The following table gives briefly the approximate horsepower requirements of some of the machines.

Machine.	Horsepower Required.
Agitators	7.5
Jordans	100 to 150
Beaters	75
Washers	35 to 75
Screens and Deckers	20
Size Mixing Outfit	50
Paper Dusters	5 to 7
Waste Paper Baler	2
Paper Machines	75
Paper Winder	7.5 to 15
Super Calender	10
Threading-in Rolls	15
Paper Cutter	2 to 3
Trimmer	2
Re-Winder (paper)	7.5

As an example of what can be accomplished by motor drive in a paper mill the following description of the installation in the Taggart Brothers Company's plant at Watertown, N. Y., may be of interest.

Paper of nearly all kinds is manufactured in this vicinity, ranging from newsprint paper; made largely from ground spruce wood and sulphite, to tissue papers, box board, wall papers and various kinds of super-calendered and highly finished fancy papers, made from wood, rags, burlap, jute, old ropes and large quantities of old newspapers. In the Taggart mill old rope and similar raw material is manufactured into a strong firm paper and is made into flour and cement sacks.

There old ropes, formerly used for all sorts of purposes, are first of all sorted, cut up into short lengths, washed, cooked, brushed out into fine individual fibers in large beating engines, subjected to other special processes and treatments and then pumped into the screens. At this point, after being screened, the fine clean pulpy material passes into the cylinder moulds at the "wet" end of the paper machine, where the process of forming the sheet is begun. From the revolving cylinder the pulp in a wet porous form is pressed against a felt between heavy rolls, where a large part of the water is pressed out and the pulp sheet is carried along on the felt between other heavy rolls where more water is pressed out and the sheet is made thinner and more firm. Later the sheet is carried onto the hot drying rolls, where practically all of the water is dried out. It is then carried through one or more "stacks" of smooth steel calender rollers and pressed with great pressure, giving to the finished sheet of paper a smooth, hard finish.

This company for many years has operated two paper machines and a large number of beating engines and auxiliary equipment and apparatus necessary to the manufacture of this kind of paper and has derived its motive power entirely from the water-power development at the mill.

At a later date a large addition to the main building of the mill was constructed and in this new machine room was installed a larger and modern paper machine. These three paper machines, as well as all of the other machinery of the mill, were driven by water wheels, but none of the wheels have ever been provided with governors, and, inasmuch as there were some variations in the speed of the water wheels driving the paper machines, on account of slight variations in load and hydraulic disturbances, and perhaps to some extent on account of the characteristics of the wheels themselves, and also on account of the fact that for a considerable portion of the year it was not always possible to obtain sufficient water power to drive the full equipment of the mill, it was finally decided to drive the paper machines as well as some of the other smaller equipment by electric power. For the purpose of drying the paper and heating the mill a steam boiler plant had been installed and was used exclusively for this purpose without deriving any motive power therefrom.

Inasmuch as each of the paper machines, on account of the various kinds of paper manufactured, required a range of speed of 3 to 1, it was found that the most desirable method of drive would be to use a variable-speed direct-current motor for the variable-speed lines of each of the paper machines, with use of constant-speed motors for the constant-speed lines and for any other purposes required.

Formerly the variable speed for the paper machines had been obtained by means of a Moore & White drive. The back shaft with the taper pulleys, for driving the various sections of the machines, were located just below the roof over the paper machines, and it was found that the machines could be best driven by setting the motor on the machine-room floor, belting to the back shaft for the variable-speed drive; and for the constant-speed drives constant-speed motors were located at the most convenient positions, controllers for the various motors were located in front of the machines, where they were within easy reach of the operators.

In addition to driving the paper machines there are a large number of printing presses also operated by motor drive, some with individual motors and others in group drives.

A vacuum drying system was designed for operation in connection with the paper machine dryers and was also used in connection with the heating system of the mill, which greatly decreased the amount of

steam required and together with the greater uniformity in the speed of the paper machines has resulted in the production of a much more uniform and better grade of paper; and the power actually required to drive the machines with the electric drive is not more than one-half of the power apparently used before, according to the rating of the water wheels and water used.

With this system of machine drive, when a change in speed of the paper is desired it is only necessary to move the controller handle forward or backward until the speed is increased or decreased as desired. To adjust the "draw" of the paper the individual belts on the taper pulleys are shifted in the ordinary way.

The printing presses which formerly received their power through jack shafts, numerous belts, long line shafts and gears and eventually from the water wheels, now driven by individual variable-speed motors or small group drives are easily and at all times under full control of the operator and can be run at the most efficient speed for the kind of work being done.

These presses are used for printing the trade-marks, brands and names of the manufacturers of flour, cement, etc., who will use the sacks produced in this plant.

Commercial Practice
Management, Rates, New Business

New-Business Developments in Menominee and Marinette.

When the 6,500-horsepower hydro-electric plant of the Menominee & Marinette Light & Traction Company was completed, the latter part of 1909, the prospects of marketing this energy in Menominee and Marinette were anything but bright. Gasoline lighting plants were numerous, there being about 250 in use; sign lighting was practically unknown; both cities were satisfied with their street-lighting conditions; and the numerous industrial plants were ignorant as to the advantages of electric power. A new business department was organized, however, and, under the management of John H. Peterson conditions soon changed.

The first step undertaken by the newly created department was a house-to-house canvass among present customers to learn whether or not the customers were entirely satisfied with their service and treatment at that time. All possible complaints were solicited, installations inspected, economy recommendations made and everything done to show the company's interest in the customer's welfare. These visits were called "Good-Service Calls" and were the first of a series of educational campaigns which have been exceptionally successful in the two cities. Today it is difficult to visit a customer or prospect who is not thoroughly convinced that the company is interested in giving good and satisfactory service and desirous of maintaining friendly relations with the public.

Having materially improved conditions with existing customers, the acquisition of new ones was then considered. A house-wiring campaign was first in order. The two cities were divided into districts and assigned to solicitors. It was the duty of each solicitor to gather complete data on each house in his district, whether a contract was signed or not. This information is tabulated on a card and today every wired, unwired and vacant house in the two cities is listed in the company's files. The results of this campaign have been very gratifying. Approximately 3,000 houses have been wired and the 4,000 still unwired are being systematically canvassed with the aid of the tabulated data on hand.

J. H. Peterson,
New-Business Manager, Menominee and Marinette Light & Traction Company.

Equal progress has also been made in regard to sign, window and street lighting. At present the company is serving about 60 electric signs, employing in the neighborhood of 2,000 lamps, lamps, and is supplying energy for 30 blocks of arch lighting. Energy for both sign and street lighting is furnished on a flat-rate basis. Signs, window and street lamps burn from dusk to midnight every night, the company controlling the circuits. More recently, in Menominee, a movement has been started for curb lighting and with the co-operation of the Chamber of Commerce and the City an extensive installation of this character is looked for in the near future.

Miscellaneous campaigns for the placing of irons, toasters, washing machines, etc., are started during various seasons of the year, and, supplemented with liberal newspaper, bill-board, street-car and direct mail advertising result in the acquisition of considerable business. Over 2,000 irons are used by residents of the two cities. In all of these campaigns the company co-operates with the manufacturers of the various appliances, encouraging them to send literature and data to its prospects and customers.

"Cheap Power" is the company's slogan in regard to the power end of the business and this, supplemented by earnest efforts on the part of the new-business department, has resulted in a power load aggregating over 3,000 horsepower. This credible showing led to the publication in a Milwaukee daily recently of an extensive article, headed "The Power City," describing in detail the diversified industries represented in Menominee, particularly. Considerable of the company's power business is obtained from woodworking plants which speaks well for the ability of the new-business getters.

Considered altogether, the results that have been achieved by the Menominee & Marinette Light & Traction Company since the organization of the new-business department, with Mr. Peterson in charge, have been exceedingly gratifying and prove conclusively that progressive ideas coupled with untiring effort can convert the small central station from a burden to its stockholders to a dividend-paying investment.

Electrical Construction

Elementary Notes on Alternating Currents.—V.

The student of the elements of applied electricity frequently finds statements, made in attempts to explain how it is that either a direct-current or an alternating-current dynamo may be used as a motor, very confusing. After all, though, if the subject is approached in the proper way, it is quite easy to get an idea of this matter sufficiently comprehensive and definite to meet the needs of the average practical electrician. Consider the direct-current dynamo, for example. When no current is flowing in the armature the power required to drive the machine at full speed is comparatively very small. When current is taken from the armature, however, the power required to drive the machine increases, the demand for power being, in fact, practically proportional to the armature current if the speed and the field current are kept at unchanging values. The reason for this is that the armature is magnetized by the current in its winding to a strength proportional to the strength of this current, and the reaction or interaction between the magnetic poles of the armature and those of the field tends to keep the armature from rotating; or in other words, tends to drive the armature in the reverse direction.

If, now, the driving power be removed and current be sent into the field and the armature from some other source, in the same directions as these currents had when the machine was running a generator, it is clear enough that the interaction mentioned will drive the dynamo as a motor and that the motor rotation will be opposite in direction to that in which the dynamo was driven. It is apparent, too, that reversing either the field or the armature current must reverse the direction of rotation of the motor.

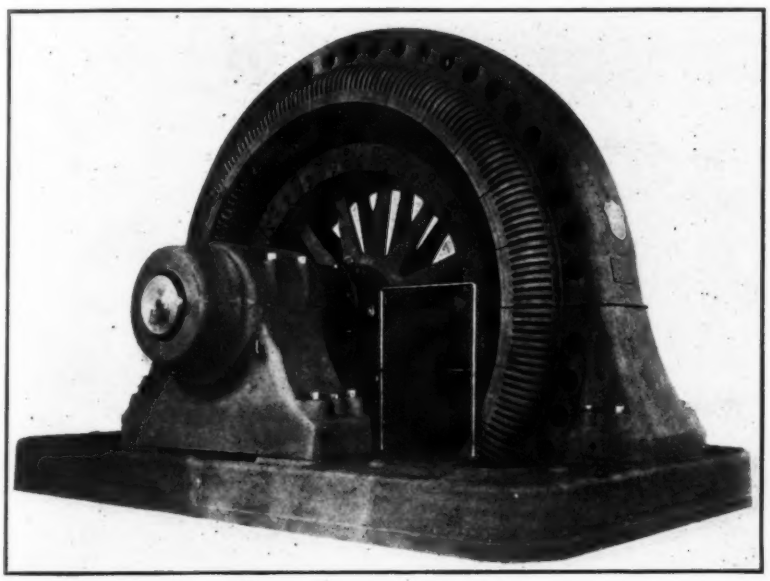


Fig. 1.—Large Synchronous Motor.

In the case of the direct-current motor the position of the brushes on the commutator is such as to give the armature magnetism, the necessary distribution to make the motor start when connected to a source of power. Moreover, as soon as the motor starts the commutator converts the current supplied to it into alternating current within the armature, and thus maintains the proper distribution of armature magnetism to insure continued rotation.

A little consideration will show that, as the armature rotates, its magnetic polarity must be reversed with the proper frequency to keep the north poles of the field magnets of the motor pulling tangentially on south poles of the armature magnetism, and south poles of the field pulling in the same direction on north poles of the armature. If the distribution of armature magnetism retained a fixed position with reference to the armature surface, the armature would simply move until south poles of the armature were brought squarely under north poles of the field and north poles of the former were under south poles of the latter, after which there would be no further rotation. This necessary reversal of magnetism is brought about by the alternations in the direction of the current in the armature which, as just stated, are effected by the action of the commutator.

A motor with slip rings instead of a commutator on the armature will operate satisfactorily if the armature is supplied with alternating current, provided the armature is first brought up to such a speed that the reversals of armature magnetism occur in the proper positions with reference to the field poles. What is known as the *synchronous* motor is essentially this sort of machine. It is clear, too, that a machine of this kind can be operated as an alternating-current dynamo.

In the larger units the synchronous motor finds extensive application now in power distribution. In construction details it is essentially the same unit as an alternating-current generator. The fact is, any alternator may be used as a synchronous motor. Like alternators, these machines are generally built with stationary armatures and rotating fields. Fig. 1 is a photograph of a large synchronous motor built by the Allis-Chalmers Company.

Fig. 2 represents roughly the arrangement of the field and armature of a single-phase synchronous motor. The field, which in the case of any synchronous motor must be energized by means of direct-current, of course, is supposed to rotate in the direction of the arrow. The distribution of magnetism due to the current in the armature may be assumed to be such, at some instant, as to cause the armature to have at that instant the polarity shown in the figure. It is clear from the figure that with the field in the position shown every pole of the field is pulled in the direction of rotation. When the armature current has reversed in direction, however, there will be north poles of the armature in some such positions as those marked *1* and *3*, while points like *2*, *4* and so on, will have south poles. Obviously, unless the field is rotating fast enough to carry, say, the south

pole of it shown between *3* and *4* past point *4* before this reversal occurs the reversal will be accompanied by a backward tug on the field. In short, it is easy to see that if the motor is not running fast enough to carry a field pole a distance equal to that between, say points *3* and *4* in the interval between two successive alternations of the armature current, the rotating member will receive impulses in first one direction and then in the opposite, and the machine will therefore not run at all. This speed is called *synchronous* speed, and hence the name of the motor.

It is helpful to remember that synchronous speed is the speed at which the motor when operated as an alternator must be driven in order to generate current of the rated frequency. It will be recalled that the frequency of an alternator is found by multiplying the number of pairs of poles by the revolutions per second. For example, a four-pole alternator must be driven at 30 revolutions per second, or 1,800 revolutions per minute, in order to generate current of a frequency of 60 cycles per second; and the speed of a synchronous motor run on a 60-cycle circuit is always 1,800 revolutions per minute.

Methods of starting synchronous motors will be discussed in detail later. The machine has to be brought up to synchronous speed with little or no load on it, and the position of the rotating member is adjusted, either automatically or otherwise, so that the maximum value in a given direction of the voltage induced in any armature coil by the dynamo action of the motor occurs at about the same instant as does the maximum value in the opposite direction of the voltage impressed upon the coil from the electric circuit to which the armature is connected. If the motor exciting current be adjusted so as to make this counter voltage of the motor equal to the impressed voltage, it is clear that under the conditions just mentioned no current would flow in the armature at all. What would actually happen, however, would be that when the mechanical power driving the motor was removed the rotating field would slow up momentarily so as to allow the counter voltage of the machine to lag behind the impressed voltage far enough to permit the armature to take sufficient current to maintain synchronous rotation. With each increase in the load applied to the motor there would be a still further sagging back of the field structure; and, if an excessive load was thrown on, the sag would be so great as to cause the field to drop out of step with the armature magnetism, and the motor would stop. This, of course, would remove the counter voltage from the armature entirely, and the resultant rush of current would open the circuit-breaker or blow the fuses in the armature circuit.

The reader must not get the impression that the momentary slowing down of the field structure referred to means a drop in the speed of the motor. On the contrary, it simply means that almost instantaneously the field poles take up a new position with reference to the distribution of magnetism around the inner surface of the armature, and that then the motor runs on with the same speed as before so long as the load remains constant. It is very much as if one of two men running together at an unchanging speed should suddenly halt long enough to drop slightly behind the other and then run on again with the same speed as before. Whether it be a single-phase, a two-phase, or a three-phase motor, or, for that matter, a motor of any other number of phases, the synchronous motor is a constant-speed machine always. Other so-called constant-speed motors, such as the shunt-wound, direct-current motor and the induction motor, may experience variations in speed with changes in load which are quite appreciable. But a synchronous motor will run at synchronous speed as long as it runs at all.

It should be explained, though, that if the load on a synchronous motor fluctuates rapidly over wide limits, the field may first drop behind the correct position and then run ahead of it, giving rise to what is known as "hunting." Hunting, however, is only a possible and an undesirable incident in the operation of the motor, rather than an inherent characteristic of operation.

Methods of Starting Synchronous Motors.

Single-phase synchronous motors are not self-starting at all, and a polyphase motor cannot be started under any considerable load. Polyphase motors are frequently started now by connecting the armature to the line through an autostarter or compensator similar to those used in starting polyphase induction motors, full line voltage being applied when synchronous speed has been attained. The single-phase motor must be brought up to speed by means of a small induction motor or some other independent source of power, and this method of starting is quite widely employed also in starting two-phase and three-phase motors. The method is so interesting, and familiarity with it is so helpful not only to engineers operating motors but to those having to run alternating-current dynamos in multiple, or in parallel, as well, that considerable space is devoted to it here.

Fig. 3 illustrates an arrangement of circuits which may be employed either in synchronizing two low-voltage single-phase alternators or in putting a low-voltage single-phase motor on the line. For the sake of clearness, the two machines are shown close together, with connections for putting them on the same bus-bars, a similar plan being followed also in Figs. 4 and 5. It is understood, of course, that in practice the motor might be separated from the generator by several miles.

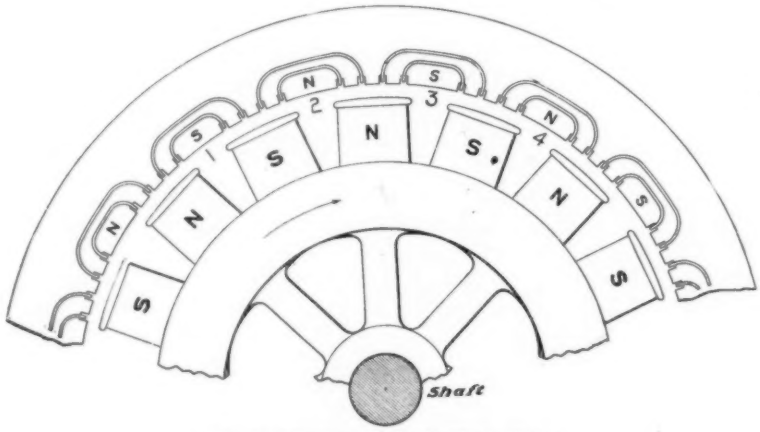


Fig. 2.—Diagram of Single-Phase Motor.

The generator in Fig. 3 is supposed to be running at its rated speed and voltage. Before the motor can be thrown on the line, it must be driven up to synchronous speed, brought into phase with the alternator, and its voltage made approximately equal to that of the alternator. Assume that at a given instant after this condition has been reached the lead *h* of the motor is positive; if the two machines are in phase at this instant, bus-bar *ace* will likewise be positive and at the same potential as *h*, and hence no current will flow in the lamp shown in the figure. On the other hand, of the motor is run too fast or too slow, there will be an intermittent burning of the lamp, the rapidity of the flicker depending on how much too fast or too slow the motor is running. The motor speed should be changed until the lamp lights up only once in five seconds or so, and then the switch connecting it to the line

should be closed just as a period of darkness in the lamp becomes complete.

The figure shows that either a double-throw switch or a six-point receptacle and four-point plug may be used in controlling the synchronizing lamp. This arrangement makes it convenient to start the motor first and synchronize the generator with it whenever such a procedure is desirable. If the motor is remote from the generator, no double-throw device will be needed, of course, nor will the horizontal wires whose ends are marked *s* and *n* be necessary.

In the case of high-voltage machines, transformers must be used in synchronizing. Fig. 4 shows a method of making connections to transformers for synchronizing two three-phase machines. At the proper instant for closing the motor switch the primary currents would have the directions indicated by the arrows just above the transformers—assuming that

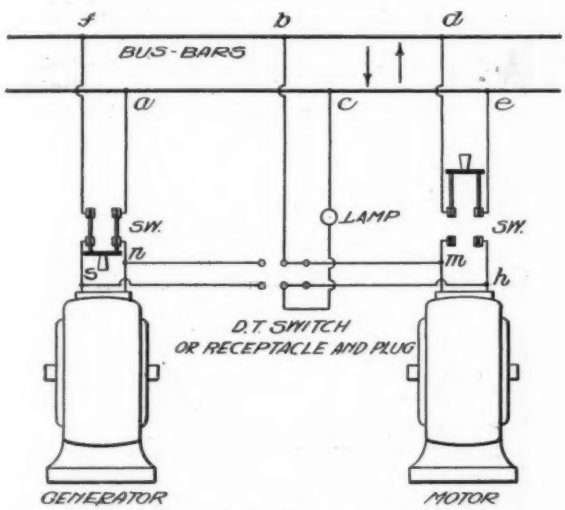


Fig. 3.—Circuits for Synchronizing Low-Voltage Machines.

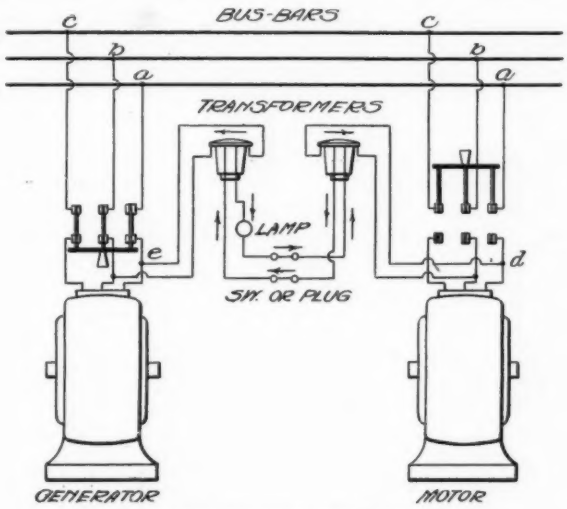


Fig. 4.—Synchronizing with Transformers.

d and *e* were positive at this moment with respect to the middle leads of the machines—and the lamp would be burning brightly. Synchronizing with the lamp bright is better than synchronizing dark, since in synchronizing dark there is the possibility of the operator being deceived by the burning out of a lamp.

By reversing the connections of the primary of one of the transformers, in Fig. 4, or by reversing the connections between the two secondaries, the proper arrangement for synchronizing with the lamp dark may be obtained. If in Fig. 3, the wire connected at *m* be carried over to the right-hand side of the circuit and the connection *h* be carried to the left-hand lead, bright burning of the lamp will indicate the proper time for closing the motor switch.

If instead of the arrangement shown in Fig. 4 the motor be located at some point remote from the generator, the primary leads of the left-hand transformer would be connected to the mains run from bus-bars *bb* and *aa*, of course.

The first time a polyphase synchronous motor is put on the line, or the first time an alternator is connected in multiple with another, it must be made certain, before the machine switch is closed, that the phases of the new machine are connected to the circuit in the proper order. Fig. 5 shows how lamps and transformers may be connected up to test for this, the transformers, of which there are two in each group, being marked *TR*. If, with such an arrangement, the lamps all light up at the same instant, the operator may be sure that the leads of the incoming machine are carried to the line in the proper order. Sometimes engineers use two-lamps continuously for synchronizing in three-phase work; but when it has been made sure that the connections are correct, one is sufficient.

The potential transformers supplied with the switchboard voltmeters can frequently be used also for the synchronizing lamps.

The writer is aware that a piece of apparatus called the synchroscope is very generally employed in the service just under consideration. But even then thorough acquaintance with the relations touched upon in Figs. 3, 4 and 5 is exceedingly useful to the operating engineer. Lamps are generally used also even where the synchroscope is employed.

Relation of Armature Current to Field Current.

If the current in the armature of an alternating-current generator leads the voltage in phase—that is, if a maximum of current occurs earlier than the corresponding maximum value of the voltage—the armature current exerts a magnetizing effect on the field poles of the alternator. Reference to Fig. 2 will help to make this statement clear. With the machine a part of which is there shown running as a generator, and in the direction of rotation indicated by means of the arrow, the magnetic polarity of the armature would be just the opposite of that indicated; there would be a north pole at *1*, a south pole at *2*, and so on around the periphery of the armature. If the current were leading the voltage, the difference between the effect produced on any field pole by the current in the armature coil just ahead of it and that in the coil behind it would be in favor of the latter coil. The resultant effect would be similar to that which would be produced by adding to the field winding other turns of a wire carrying current in the direction of the actual field current.

The converse of the foregoing is also true: a lagging current in the armature of the alternator tends to weaken the field. This is very important to remember. It shows, for example, that greater exciter capacity is necessary to maintain a given voltage with a lagging load than when the power-factor is unity.

In the case of the synchronous motor, a strong field current tends to make the armature current lead the impressed voltage, while a weak field permits the current to lag. In other words, the power-factor of the motor can be adjusted by adjusting the field current. It follows, therefore, since the voltage impressed on the motor is usually constant, that the strength of the armature current for any given load on the motor can be changed at will by changing the strength of the current in the motor field. The curves in Fig. 6 show this. Here armature current is plotted vertically on the line *OX* and the field current—or, what amounts to the same thing, the counter voltage of the motor—is plotted along the line

OY. Curve No. 1 is for a machine running at practically full load, and curve No. 2 for the same motor running light. For field current enough to cause the counter voltage to be *OC*, the armature current has the value of *OP* and is lagging, on full-load; with excitation *OR*, the current reaches the minimum value *OH*, and the power-factor becomes unity; for any larger value of exciting current, the armature current increases, and leads the voltage impressed on the motor. For instance, when the field current is large enough to produce a counter voltage *OG*, the armature current is again *OP*, but is now leading the impressed voltage.

It is interesting to note in this connection that the writer knew an operating engineer to burn out the armature of a synchronous motor once as a result of the fact that he did not know that, for any load, the amount of current pulled from the line depends upon the strength of the motor field. The machine was left fully loaded and with its field very weak.

The Synchronous Condenser.

The fact that an over-excited synchronous motor draws a leading current from the line to which it is connected is taken advantage of as a means of power factor connection. If the power-factor is low, due to a heavy lagging current in a transmission line, an over-excited synchronous motor may be connected to the line and the leading wattless component of the motor current will tend to neutralize the lagging wattless component of the rest of the line load. A machine installed for this special purpose is called a synchronous condenser. The use of synchronous condensers is quite general on the larger power systems. In addition to their corrective effect on the power-factor of the line to which they are connected, such machines are also generally made to do more or less motor service at the same time. In fact they seem to operate most satisfactorily when run at 60 per cent or so of the rated mechanical load.

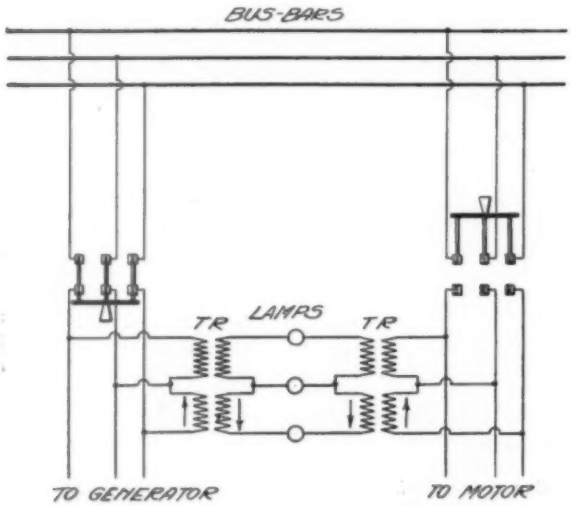


Fig. 5.—Circuits for Testing Order of Phases.

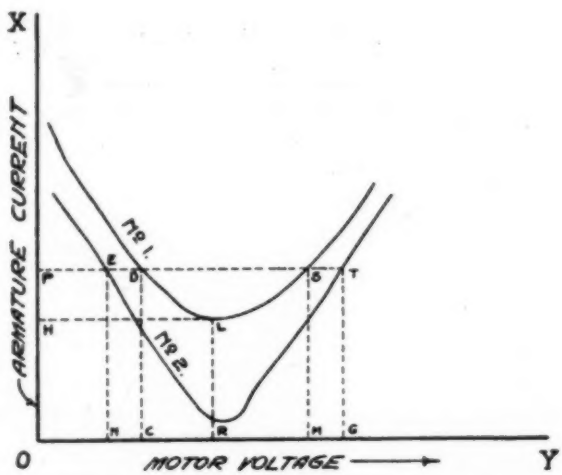


Fig. 6.—Relation of Armature Current to Excitation.

Remarks on Electrical Contracting.[1]

If I were asked to summarize the matters which received most attention at the recent convention of the National Electric Contractors' Association in Denver, I should say they were co-operation among contractors for the sake of improving the quality and service rendered by them, and the education of the contractor to be more just to himself and to his customer.

I feel that quality and service can be handled together, and would say that they can be divided as follows.

In the first place, personal likings should be left out of account in buying stock which the customer wants; and, secondly, the contractor should buy nothing he cannot sell at a profit. Moreover, the contractor should cut out estimating for people who refuse to permit him to make a profit, and thus he would conserve his time. Again, the contractor should give full measure—no more nor any less—at each transaction. Furthermore, he should turn his stock over as often as possible. And, finally, he should know costs and what makes them, and should cut them as low as is possible without sacrificing quality and service to the consumer and being unjust to himself.

To follow up the above, taking the first section—how often does an architect specify a certain kind of switch, and how much time do you consume telling him that something else is just as good? Don't you think it would please him more if you gave him what he wanted, instead of telling him that you buy the other kind in large quantities and that it would cost you a few cents more to give him what he wants? You may get him to grudgingly allow you to use what you want but I think that he would be much better satisfied if you gave him what he asked for. There are many things that a contractor spends more money and time trying to substitute than the difference in the cost of the article which is specified against the article substituted, and then again often the article substituted is inferior to the article specified. My suggestion is to stop substituting. Give your customers what they ask for, and stop letting genial salesmen tell you what your customers need, but let the customers do the specifying and you give them the service by supplying them with what they want.

When a customer has no preference sell him the very best the market affords; therefore, educating him to a high standard, which means more profit for you and a very much satisfied customer.

To buy nothing that you cannot sell at a profit, summed up, means cut out unnecessary purchasing, unnecessary estimating and conserve your time so that it can be turned into more profitable channels. In other words, I would say analyze your needs carefully, don't be so anxious to tie up your money and credit every time a salesman offers you an additional 10 per cent on any article. Before purchasing make sure of two things—first, can I turn it over soon enough to pay me for tying my money and credit up, and second and most important—am I really saving any money?

In these busy times some people have a notion that they are making money by buying cheaply and these same people

1 From an address by W. S. Hanbridge. Abstracted from the *Journal of Electricity, Power and Gas.*

think that at any time they can get an article five or ten per cent cheaper than the market price, that they are making money and they lose all sight of the fact that often the quality is not there, that depreciation and interest on the investment often make a cheap article expensive by the time it is turned over; and last, but not least, often Mr. Shrewd Buyer ties up his money or credit in such a manner that his assets are really the stock on his shelves, which in a pinch are worth considerably less than either the cash or his credit.

In reference to reckless estimating, analyze the people to whom you are sending your estimates; remember it costs money to prepare a proposal. If a man accepts your proposal he usually expects you to live up to it to the letter. So, therefore, why should you not enter into a contract with him before you give him a proposal? you giving your time and money to prepare a careful estimate; he giving you an absolutely square deal and agreeing if you are the lowest bidder, to give you the job. I would say cut out all who do not give you this treatment.

Turn your stock over as soon as possible. If you could buy an article today, put it in the job tomorrow, collect for it the next day, pay your jobber the next day, you would have reached the highest point of efficiency known in the business world; but as this is impracticable, I would say, buy only what you need, install and bill as promptly as possible; get a reputation for collecting promptly and also a reputation for paying your bills promptly. I think that if the average contractor would observe these four rules he would make more money than by trying to beat the game by quantity purchases, which usually lie on shelves a long time.

I would say to the electrical contractor, figure your plans and specifications carefully and honestly, make notes of what you know to be technical errors, and do not sign up a job until you have a thorough understanding in writing of every one of the technical errors.

In making the above statement I do not deem it necessary for the electrical contractor to have second sight and take care of things that architect and owner have not thought of, but I do think that when a man calls in an electrical contractor for an honest estimate he is entitled to such suggestions as will give him a perfect job of wiring covering the results specified.

A reference to additions to plans and specifications is in order here. After having a perfect understanding the electrical contractor is entitled to an extra for everything added and the owner is entitled to nothing which is not specified. On all extra work there should be added a reasonably fair profit. A contractor must be just to himself and he must be fair to his customer, and the evils that exist in billing extra work has caused a loss of more customers than any other known evil. I personally believe that an extra is nothing more than part of a contract and that a contractor is entitled to the same profit as his original contract allowed him; of course assuming now, that he has been fair with himself in figuring the original contract. But to the contractor who takes contracts at a low margin of profit in order to get the extra work, I will say that I believe that some day a bright attorney will spring the defense in some of our courts, that a man is entitled to no more profit on his extras than he originally asked for on his contract, and I feel that a judge in rendering a decision along that line would do so on the grounds that the contractor had established his own price.

It is absolutely necessary at all times to keep customers satisfied, as it is much easier to lose a customer than gain a new one. So by being consistent in your charges, and rendering good services, keep the quality up to standard, and you will gain the confidence of your customer. To know your costs and what makes them; I am not going to enter further into this subject; but will emphasize that knowledge is power can never be illustrated any better than in the above clause. Knowing costs and what makes them gives you the power that is necessary to do a thing because it is right, and remember only those things live which are based on right. You may have a perfect working organization, your secretary may be able to tell each one of you what is the right thing to do and even by pressure make you add enough profit so that you cannot lose money, but the correct principle will only live and grow stronger when it stands out in the minds of each member braced on all sides by a perfect knowledge of costs. Then each member will be a support unto himself and will do things because he has knowledge that if he does otherwise he will injure himself. And leaving out a gambler's chance, no man will do anything knowingly which will injure himself.

When you have learned your own costs, do not be afraid to help your competitor learn his. By so doing, you help yourself as well as him. Moreover, the man who knows his costs and of what they are composed can approach a prospective customer with such confidence as to lead the customer to have confidence in him, and when one has obtained the confidence of a prospective customer, half the battle is won. To my mind, it does not require salesmanship to secure business for an electrical contractor; but it does require a broad-gauged man who has confidence in every statement he makes. Such a man has to know his business as an electrician, and be familiar with the elements of the contracting business.

ALTERNATING-CURRENT MOTORS: THEIR APPLICABILITY AND CARE.

By F. McNeill.

In large installations of induction motors it is of greatest importance to have the machines working as nearly as possible to their rated capacity. This is true, of course, with every class of machinery, but it is especially true of induction motors on account of the fact that underloaded induction motors have a very low power-factor.

There are several reasons why a low power-factor is objectionable; one is that it takes up the generator current capacity; another is that it requires additional copper to conduct the superfluous current; one big reason is that low power-factors require greater generator field excitation.

This fact was brought home to the writer with great force when a 600-kilowatt Allis-Chalmers turbogenerator in his charge burned out its field coils. The machine was of the three-phase, 60-cycle, 440-volt type, and ran at 3,600 revolutions per minute. It was guaranteed to carry 50 per cent overload continuously without overheating. The rated capacity was 790 amperes and the load being carried was 1,050. Fifty-per-cent overload would be 1,185 amperes. The ampere load carried was 135 less than the guarantee. The kilowatt load, however, was only 560, which is 40 kilowatts less than the full-load rating. As the ampere load was 1,050 and the voltage was 440, the apparent load would be

$1{,}050 \times 1.732 \times 440 = 800$ kilovolt-amperes. The actual load being 560 and the apparent load 800, the power-factor would be $560/800 = 0.70$. After the accident the specifications and guarantee were read over carefully and it was found that all current at that low power-factor caused the machine to require an exciting current that the field coils were not built to withstand; hence a gradual charring of the insulation and ultimate short-circuiting of the wire resulted in a complete burnout of the coils.

There should always be an ammeter in the field circuit of alternators of any size, and the maximum allowable field current should be ascertained from the manufacturer.

When a low power-factor is caused by a number of underloaded motors, the remedy is simple. Take readings of the work being done by each machine individually, take out some of the motors that are running light and add their work to some other motors that are not yet loaded to their capacity, not losing sight of the fact that the lower reading includes the losses

of the motors tested. These losses will be eliminated in the motors taken out of service; that load will not be added to the machines taking on the additional work. For instance, the writer had two 50-horsepower motors working in close proximity to each other; one was taking 45 horsepower, the other only 15.

The total power required to do that work was 60 horsepower when two motors were used; when one machine was taken out, the remaining one did all the work and consumed but 54 horsepower; hence there was a saving of power as well as raising of power-factor.

Placing motors properly with respect to the driven machinery and other surroundings is a matter that should be given thorough consideration.

Belts should always be run in a horizontal position for two reasons; first, because the belt pulls better in that position because the weight adds to the tension and the sagging of the top size (the tight side should always be on the bottom) adds to the arc of contact around the pulleys; the other reason is that with most motors the life of the bearings is doubled. The journal boxes will enter the housing either end first with the majority of makes, and only half of the bearings wear out at a time; that is, on the pulley end, the bearing wears only on the side nearest the driven machinery, and the bearing on the opposite side of the motor wears only on the side farthest from the driven machinery. When the bearings wear out on one side just turn them end for end and you have new bearings in so far as their wearing qualities are concerned. Changing and filtering the oil at least once a month will greatly prolong the life of the bearings.

Motors should never be placed in damp localities, nor where they will come in contact with acid fumes of any kind. The writer had a great deal of trouble with acid fumes not long ago, burning out the coils of several motors before the cause was located.

At first the machine was moved to the floor above, out of the acid fumes, it was thought, but they followed the belt up and did almost as much damage as before. A two-foot extension was then put on the motor shaft, so that the machine did not set directly over the hole in the floor that the belt came through; the result being that all trouble was eliminated.

It is sometimes necessary to place motors in places that are slightly damp. No trouble will be experienced as long as such machines are doing enough work to keep them warm or even moderately hot, but if by any chance, they get as cool or cooler than the room they are in, they will absorb moisture and trouble is sure to ensue. In such places the ceilings sometimes sweat, the water dropping into the motor; in such cases the usual iron or wooden covering over the machine is of no avail, as it will sweat as badly as the ceiling, ordinarily. One way of overcoming this difficulty is to cut a piece of galvanized iron, about No. 16 gauge, large enough to form a good roof over the motor. To this is fastened, by means of shellac, a sheet of asbestos board about ⅛ inch thick. This arrangement is placed over the motor with the asbestos down. The asbestos prevents the galvanized iron from sweating. Where these conditions are very bad the entire belt should be covered in a like manner.

Polyphase induction motors having the squirrel-cage type of rotor are subject to ills that are hard to locate at times. A machine may be running along giving the best kind of service, and suddenly, with no apparent cause, slow up preceptibly and run very hot. There are three possible reasons for this, namely, overload, loose rotor bars, or the machine is running with one phase open. Polyphase motors will continue to run with one phase open but will not start up from rest under those conditions.

To test for external open-circuit use a portable voltmeter, making the test at the motor terminal. If the broken wire is in the external circuit, the broken wire will show only about half the line voltage between itself and its mates, and not an open circuit as would naturally be expected; an electromotive force is generated in the motor coils and is shown by the voltmeter.

If, however, the open circuit is internal, the line will test out all right. To ascertain if the trouble is an internal open-circuit, simply shut the machine down; if that is the trouble the motor cannot be started again in the usual manner.

Should the machine start up again after coming to rest, then the trouble is neither internal nor external open-circuit, and is without doubt the fault of the rotor; that is, loose bars or poor contact between the bars and connecting rings. This is a very common and annoying trouble. The only remedy is to take the rotor entirely apart, clean the ends thoroughly and tin them, and when reassembling float solder between the bars and rings as the screws are being tightened. This is best done with a gasoline torch, as a soldering iron will not float the solder under the bars far enough and is much slower.

There is a simple but very valuable little trick in making emergency repairs to stator windings that the writer has been practicing for some time; that is, cutting out burned-out coils.

It is not necessary to be an armature winder to do this; nine times out of ten the ruptured coil or coils can be located without testing for open-circuits, by reconnect the coil ends from the rotor; that is, the rupture will be visible. The burned-out coil can easily be traced to where the end connections are made. Every coil of course has two ends and they come out of the coil together. Once the coil ends are located, what is easier than to disconnect the coil ends from the wires connected to them and connect those wires together? The current will then be by-passed, as it were; the coil will be cut out. Sometimes the coil cut out will get hot and smoke even after it is disconnected. This is caused by short-circuits in that coil and the currents in it are induced by the other good coils. Should this trouble develop after the machine has been started up, it is only necessary to cut the wires of that coil so that the induced currents will not have a completed circuit.

The writer has cut out as many as 12 coils out of 54 and had the motor run satisfactorily. The reader will understand that the foregoing is only recommended in emergency cases, where a motor burns out and no others, or facilities for proper repairs, are at hand. Cutting out coils lowers the efficiency and capacity and unbalances the circuit.

There are a great many people who think and argue that the alternating-current motor cannot be a successful competitor of the older and more flexible direct-current machine, on account of speed regulation. That is a mistaken idea; the alternating-current motor can be used anywhere that a direct-current machine will work and a great many places where a direct-current motor would be entirely useless.

In large installations the variable-speed motor will always be found in the minority.

There are variable-speed alternating-current motors on the market that answer the purpose as well as the direct-current machine. They are not, however, as simple as the alternating-current constant-speed motor, but no more complicated than the direct-current variable-speed machine. This, then, in the writer's estimation, destroys all arguments in favor of direct current over polyphase alternating-current for power purposes.

It is not good policy to use direct-current motors where there are any explosives or highly inflamable materials manufactured, on account of the liability of sparks from the brushes starting a conflagration.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Portable Test Set.

The repair man is frequently called to the home, the factory, or places of business to repair motors and heating units of different kinds, where the owner cannot spare the appliance long enough for it to be taken to a shop.

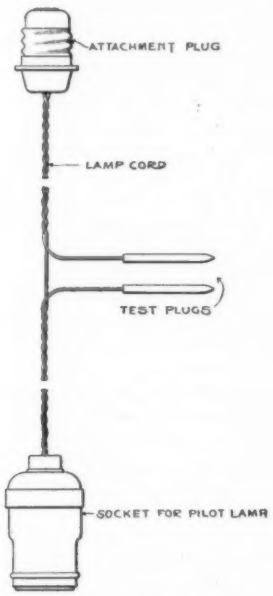


Fig. 1.—Completed Device.

The only thing to be done at such a time is to do the work right there and then.

In cases of this kind a portable test set of the following description is an almost indispensable addition to a repair man's kit of tools. It can be quickly attached to any Edison-base outlet and is at once ready to test for grounds, short-circuits or open circuits.

Make up a regular extension cord about ten feet long, with a keyless socket on one end and an Edison attachment plug on the other. About two feet back from the socket, cut one side of the lamp cord, and attach two feet of single lamp cord to each of these wires. To the ends of these cords solder a piece of No. 6 bare copper wire about four inches long. Tape these well, to protect the hands from the juice. A lamp of small candlepower can just as well be used as a larger one, as it only acts as a pilot light anyway. A lamp guard can be used to good advantage to protect the globe from sudden jars.

It will be found that much valuable time will be saved by both customer and repair man if one of these sets is kept constantly on hand. It is not cumbersome to carry.

W. A. Hines.

Testing the Wiring from the Bell Circuit.

Some time ago I wired an old house, and after being all done I wanted to put a test on the job but did not have a battery and bell with me. As the house had an electric door bell installed, I hooked two No. 14 wires on the push-button side and ran them to the outlet of the basement circuit. As all the cutouts were in place the whole job was tested in this way, without removing either the batteries or bell.

Joe Braith.

Fuse for Testing Purposes.

I do a lot of trouble hunting, and as New-Code fuses are too expensive to waste in many cases of doubtful loads, I devised an economical fuse—to be used temporarily, of course. I got a blown fuse and drilled both ferrules so that a carbon-battery binding screw could be fastened on it, and under the nuts placed the required size of fuse wire. The device is illustrated in the accompanying sketch. The use of it while testing out circuits sometimes means a considerable saving.

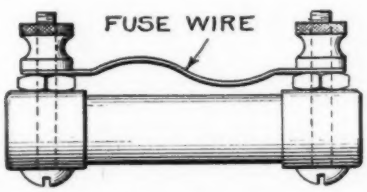


Fig. 2.—Cartridge with Fuse in Position.

Ben R. Browne.

Tool for Splitting Duplex.

A great many wiremen have some difficulty in splitting twin wire owing to the fact that the knife runs off the center and off the wire. I have found the tool described below of great help in overcoming this difficulty.

Take an old steel fork with three prongs; bend the center prong out and sharpen it like a knife blade; now bend it back about one-half an inch beyond the others and bend the two outside prongs close enough to let a piece of twin wire be passed between them. Thus the two outside prongs will serve as a guide for the middle one which will cut the braid.

E. W. Dullea.

A Difficult Piece of Conduit Work.

We had to install an additional electric generating plant, which was about 500 feet away from the main generating station. Twelve three-inch conduits were run underground, and there were three manholes. When we tried to fish with an ordinary steel snake, it was found to be almost impossible to do so, as the snake would double up in the large conduits. Then we secured some absorbent cotton, tied a ball of fishing cord on to it, inserted the cotton first, with the string attached to the end, made a connection to the compressed-air line and thus blew the cotton with string into the pipe. It took an astonishingly short time to fish this one conduit. After the string was through we attached the snake at each manhole, and to the snake the wire.

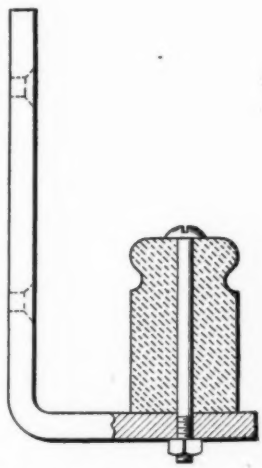


Fig. 3.—Bracket and Insulator.

In case no compressed air is handy, a large foot pump will do the trick.

L. G. Frank.

Is This Installed Out of Doors?

The accompanying figure illustrates a convenient form of house bracket which I use when I wish to connect a barn, wash-house or other out-building with the house meter.

It is made of 3/16-inch by 1½-inch strap iron, bent in the form shown in Fig. 3. Two countersunk holes serve for screws to fasten the bracket to the wall. A ¼-inch bolt and No. 45 knob complete the bracket.

The bracket is very convenient when a standard type cannot be used.

A. R. Cummings.

Legal Notes

METHODS THAT MAY BE USED BY PUBLIC-SERVICE COMPANIES TO OBTAIN SECURITY FOR SERVICE.

By Maguire and Mooney.

In order that a public-service company may render efficient service to the public, and to those who demand it, it must be permitted to keep its capital, or the greater part of it, in the productive end of the business, and not to permit it to be eaten up in bad debts, desperate accounts or even delayed accounts. Its service to the public must be for cash as nearly as possible. It is a well known business principle that the cost of production increases as the cost of collecting for the service increases. If all payments to the company are prompt, then a great deal of work is not needed, and a great amount of money is saved; but if the payments are not prompt a great amount of the capital is invested in these delayed accounts.

Realizing this business principle, the method was adopted of forcing the public to pay for service as it obtained it. This grew up first as rules of the companies and later it became recognized as part of the franchise and then became founded in law. It was recognized as being very good in permitting the company to use almost its entire capital in its production. Making all accounts due the company payable each month enabled the company to exist on a small capital compared with what would be needed to make bills payable in 60 or 90 days. And public-service companies were not dealing with those strongly imbued with business principles. The great majority of the customers of public-service companies could not be effectively dealt with except under a strong rule for the collection of the accounts. It is not meant that they were dishonest but that forgetfulness would force the company to carry the accounts.

A very new departure in the method of collecting electric light bills has arisen in the case of the City of East Grand Forks vs. Luck, 107 N. W., 393. Under a provision of the law of Minnesota, when water or light is furnished by a municipality to a tenant, the owner is also made liable. Whereas this rule has arisen in a case where the city furnished the light, the question is not changed by the fact that the city, rather than a private corporation, was the furnisher of the current. Even though this question has not arisen in any other case, there seems to be no reasonable doubt of the constitutionality of such laws. In this case suit was brought against the owner of certain premises for $75.29 for electric lighting. The court held that the provision in the statute creating a liability against the landlord was reasonable. The court held that it was quite reasonable to require the owner of the premises to respond personally for the debts incurred by the tenant for electric light and water rent as to subject the premises to a lien and sale.

The right to exact security of customers or require payments of rental in advance is an important division of this topic. One of the important cases deciding this is Buffalo County Telephone Company vs. Turner, 118 N. W., 1064. This company was a farmers' telephone company charging $1 a month for service, which amount was payable six months in advance. Turner refused to pay six months in advance, and when the company cut off his service brought suit for an injunction. The court held that a rule of rural telephone companies making telephone rental due in advance was reasonable, but this case does not apply to all kinds of public-service companies. Such a holding as this would not have been made had the company been financially strong, but it was fashioned in the manner of all rural telephone companies—not for profit. This method would not be applicable to large public-service corporations. They could adopt a scheme to exact security from the customer. The delivery of electric current necessarily is in its consumption. The amount can be ascertained only as consumed. The company is bound to furnish on application, and it is but just that it be not compelled to supply unknown or irresponsible persons without assurance in some form that it will be paid for. A rule to exact security is not based on the theory that the people as a whole are dishonest, but it has a right to adopt a rule which, while giving the honest citizen what he pays for, will prevent the dishonest from getting that which he will never pay for. Accordingly, a rule of this kind is reasonable and can be enforced.

A mechanic's lien is a lien that is given to one who places an improvement upon land or buildings thereon situated. It is very important to all builders to know the provisions of the mechanic's lien laws of the state in which they are working, and it is just as important for the public-service companies to understand the provisions. The theory of the mechanic's lien laws is to give a certain class of persons an additional remedy, the lien attaching to the real estate. Now, a peculiar provision of these laws makes the lien ordinarily just as good whether the owner ordered the work, or a contractor for him.

The novel question as to the right to a lien for electricity under the lien laws or similar laws does not seem to have been presented except in one late case, Grants Pass Banking and Trust Company vs. Enterprise Mining Company, 113 Pac., 859. In this case the question arose in a controversy between creditors as to the validity and priority of a lien. A suit was commenced on March 12, 1907, by the Grants Pass Company to foreclose a mortgage of certain property executed to it by the Enterprise Mining Company to secure the payment of $6,000. The Condor Water and Power Company was also joined in this suit. It answered and denied that its claim was subordinate, and set forth facts that showed it had a prior lien on the real estate. The Condor Company then started suit to enforce the lien it claimed. Under a written contract it was to furnish electricity for illumination and for the operation of a quartz mill on the premises, and pursuant to this contract it had supplied the Enterprise Mining Company with electricity worth $3,570.28, on account of which $1,527.20 had been paid. The law of the State of Oregon provided that any person furnishing provisions, materials or supplies for the working or development of any mine would be entitled to a lien. The court held that electricity, under this law, was a supply. Electricity, when employed to illuminate a mine, enables workers to work therein with almost the same success as in the

daylight, thus materially contributing to the search for and the development of a mineral vein. If by the use of electricity certain work can be done that could not otherwise be performed, electricity is a supply.

Of course, it is not to be considered that this law in Oregon is the law in each and every state. The provisions of the mechanic's lien laws of the various states are very different, yet they are all based upon some certain theory. And it is the intention of this article to expound the practical theories of this law.

In order that a lien for fixtures furnished by an electric company may be held valid it is necessary to find out the various opinions of the courts. By some courts electrical fixtures have been declared as attached to the real estate, whereas other courts have declared them mere personal fixtures that could be removed at pleasure. The declarations of these courts on this point may seem very much at variance, yet they were based on state laws that varied widely. One state may have a very liberal lien law, while another may be very strict. It is, accordingly, necessary to consider all phases of the matter.

A tenant's right to remove electric apparatus installed by him is determined by the general rule whether or not the article has retained its personal nature or has acquired the character of the realty by being attached to it. There are three parties to each transaction of this character, the company that furnishes the fixture and the current, the owner of the premises and the tenant. The relation the company bears to the premises is often through the tenant. The landlord is not a party to many of the transactions. The public-service company sells the tenant current and supplies him with fixtures. The current is paid for at the end of certain periods, so at all times the tenant is indebted to the company. The fixtures are often sold on the easy-payment or deferred-payment plan. On account of this it is necessary for the company to protect itself by many devices against those of its customers who fail to pay for service or for fixtures, and who leave the state or commit any equally annoying act. Thus, a tenant may purchase fixtures on the deferred-payment plan and before they are paid for remove them out of the state. It is true that this may be a crime, but a criminal prosecution would not reward the company with the cost of the article. Thus, it is important to determine whether a lien would be valid against the property. In each particular case regard must be had to the fixture itself, the intention of its installation—whether for trade and business, ornamentation, or convenience in the occupancy of the premises. For the tenant that purchases fixtures and then takes them out and evades payment no lien can attach to the premises. The whole theory of the law is that some benefit was attached to the real estate, so if the fixtures are taken away any benefit that did attach was removed. But it is necessary to consider the fixtures purchased by tenants that are left in the building. The landlord surely obtains the benefit of the fixture, and it seems proper that he should pay for it. But in looking at it from the other viewpoint, it can readily be seen that the esthetic tastes of some tenants could easily bankrupt the landlord by making him liable for certain expensive fixtures.

When the fixtures are readily detachable without injury to the premises, they may be removed, and the landlord is not responsible. But when they are attached with a view to permanency they are personal property no longer, but become part of the realty.

In McFarlane vs. Foley, 60 N. E., 357, the court held that chandeliers put into a building by direction of its owner, with the intention on his part that they should become part of the realty, are fixtures, so that the one putting them in has a mechanic's lien therefor.

Accordingly, we see that the tenant cannot bind the landlord to pay for fixtures purchased by the tenant, unless the landlord agrees to the purchase, or it is the intention of both the landlord and tenant to permit the fixtures to become permanent attachments to the realty.

There are three methods of determining whether an article becomes attached permanently to the realty, and these three must concur. (1) Real or constructive annexation of the article in question; (2) adaptation to the use or purpose of that part of the realty with which it is connected; (3) the intention of the party making the annexation to make the article a permanent part of the realty. In determining the intention, the nature of the article annexed, the relation of the party making the structure and mode of annexation, and the purpose for which it was made, must all be considered.

In Missouri, in **holding chandeliers** to not be fixtures under the law, the court determined the case on the evidence relating to the intention of the parties. The exact dispute in the case (Frank Adam Electric Company vs. Gottlieb, 86 S. W., 901) was whether an intention fairly appeared from the evidence. The evidence showed that the attachments were bought for use in the houses. Subsequently the houses were sold to different purchasers. This, the company contended, showed the intention of the owner to treat the chandeliers as part of the realty, because he sold them with the property. The fixtures were attached in the ordinary manner, as, of course, they would be, whether the owner of the property designed to treat them as part of the realty or as personal chattels. In fact, this idea of intention cannot be determined from the manner in which the articles are attached, because they all are attached practically alike. Fixtures alone are not things which indicate whether or not they are designed to be a permanent appurtenance. But the mere fact that the owner of a house buys fixtures and has them attached has no tendency to prove an intention one way or another. In the majority of cases the owner takes no thought as to whether he will leave the fixtures if he sells it, or if he continues to occupy it.

In another case the Baltimore Supply Company furnished the Kernersville Light and Power Company for its light and power plant material consisting of insulators, wires, crossarms, transformers, and other electrical supplies and equipment. The wires furnished were attached to the dynamo, but were blown down and disconnected. The Baltimore Supply Company properly filed its claim for a mechanic's lien but it was denied that the material furnished was the proper subject of a lien. The court found that the transformers, and wire were strung on the electric light poles and that the other material was never used in the Kernersville Company's building. Accordingly the petition for mechanic's lien was denied.

According to all these cases and rules, drop lights, electric irons, washing machines and electric stoves could not be considered as fixtures, but entirely as personal property. Chandeliers and light fixtures of various kinds would or would not be considered part of the realty, depending entirely upon the facts of each case, when such facts were determined according to the rules set forth above.

Under almost any mechanic's lien law, companies that wire houses are entitled to a lien for their work and for the necessary materials furnished. The necessary connecting and distributing wires, when made fixtures, become the property of the owner of the building in which they are placed, and the value of the material furnished and of the labor employed in making the improvements are burdens which may be imposed upon the land. And electrical wiring put into a building by a tenant is a part of the realty after installation, even though the wiring could

be pulled out without material injury to the building; but this does not entitle the company or contractor to a lien of itself.

Electrical machinery has always been held to be removable, and, therefore, no lien could attach to the property. One of the well known cases is Brown vs., Reno Electric Light and Power Company, 55 Fed., 229, in which the court held that electric machinery used in the operation of a lighting plant was a trade fixture subject to removal by the lessee who placed two dynamos and other machinery.

Public Service Commissions

WISCONSIN.

The Wisconsin Railroad Commission has issued a decision and order requiring the Milwaukee Electric Railway and Light Company, the Plankington Electric Light and Power Company, the Commonwealth Power Company and the Wells Power Company, all of Milwaukee, to abandon their respective rate schedules for business light and power, and to substitute therefore a uniform standard schedule of rates as devised by the Commission. This decision is the result of an investigation of the rates, rules and practices of the seven electric utilities operating in the business district of Milwaukee, which was undertaken in consequence of a complaint filed by the Milwaukee Electric Railway and Light Company. From the facts disclosed, it was evident that at least one of the utilities had resorted to questionable and discriminatory methods in an attempt to extend its business. In order to attract certain consumers from its competitors, this company had made it a practice to offer lighting service at power rates under a somewhat peculiar interpretation of its rate schedules. These rates were generally lower than the lighting rates of the other companies. Furthermore, it was shown that the manner of computing the monthly bill was, in many cases, discriminatory, and that the company had made it a rather general practice to supply fixtures and other equipment to its prospective consumers at a price very much below cost. These, and other factors, had brought about a condition of affairs which would have ultimately resulted in a ruinous rate war.

The Commission has always rigorously adhered to the policy that destructive competition should not be permitted under any circumstances, and since, in the present case, the same territory is served jointly by several companies, this could be accomplished only by making the rates, rules and regulations the same for each company. The rates of the Milwaukee Electric Railway and Light Company, the Plankinton Electric Light and Power Company and the Commonwealth Power Company will be reduced as a result of the order, but the earnings will still be sufficient to yield a reasonable return upon the investment. Although the Railway Exchange Building Company, the Colby and Abbott Building Company and the Mohler and Hummell Realty Company were included in the investigation, they were not included in the present order, but will be considered by the Commission at some future date.

The order provides that all of the companies affected by the decision shall adopt the following standard schedule for electric service:

Demand Charge:

$42 per year for each kilowatt of demand up to 10 kilowatts.

$30 per year for each kilowatt of demand for the next 50 kilowatts.

$24 per year for each kilowatt of demand in excess of 60 kilowatts.

Energy Charge:

4 cents per kilowatt-hour for the first 1,000 kilowatt-hours during the month.

3 cents per kilowatt-hour for the next 3,000 kilowatt-hours during the month.

2 cents per kilowatt-hour for the next 6,000 kilowatt-hours during the month.

1.5 cents per kilowatt-hour for all energy in any month in excess of 10,000 kilowatt-hours.

The foregoing rates are to apply to all consumers using the company's service and receiving free lamp renewals; to consumers who do not receive free renewals, the rates are to be decreased 0.5 cent per kilowatt-hour.

It is specified that the maximum rate of charge for electric lighting service in any one month shall not exceed:

First 200 kilowatt-hours during month, 10 cents per kilowatt-hour.

Next 200 kilowatt-hours during month, 8 cents per kilowatt-hour.

Next 200 kilowatt-hours during month, 6 cents per kilowatt-hour.

All over 600 kilowatt-hours during month, 4 cents per kilowatt-hour.

The above maximum rates are about 2 cents per kilowatt-hour lower than the rates previously in effect.

The order provides that service specified as power service may be contracted for the option of the consumer at the following maximum rates

First 200 kilowatt-hours in month, 6 cents per kilowatt-hour.

Next 200 kilowatt-hours in month, 5 cents per kilowatt-hour.

Next 200 kilowatt-hours in month, 4 cents per kilowatt-hour.

All in excess of 600 kilowatt-hours during the month, 3 cents per kilowatt-hour.

In order to avoid misunderstandings, the Commission has specified what shall constitute lighting service and what power service. According to the terms of the order, lighting service is to include electric energy furnished for lamps and other appliances utilized for illumination purposes; motors and appliances other than lighting equipment when provided with a starting device designed to limit the starting current to a value not exceeding 2.5 times the full-load current; alternating-current motors of 0.25 horsepower when wound for 110 volts, and of 0.5 horsepower when wound for 220 volts; direct-current motors of one horsepower. An aggregate rated capacity of motors and appliances, not to exceed two kilowatts, may be included in this class when used in connection with lighting equipment and when the connected load of such motors and appliances does not exceed the aggregate rated capacity of the lighting equipment.

Power service is to include electric energy utilized for motive and heating purposes and miscellaneous lighting service, when the demand arising from the lighting service is not in excess of 20 per cent of the total simultaneous demand for lighting and power service.

Where the demand is to be assessed and not measured, the order provides for lighting installations of 2 kilowatts connected or less, that 100 per cent of the first 300 watts connected, plus 66.7 per cent of the excess, shall be considered the demand. For power service,

75 per cent of the connected load, if less than 2 kilowatts, is to be considered the demand.

To obviate further trouble and discrimination in the matter of fixtures, the Commission has ordered that the companies shall connect service lines with the premises of the consumer. Fixtures, appliances and equipment may be sold at a price not less than the cost price, including interest at 6 per cent, or they may be leased at rentals which do not amount to less than the sum of the ordinary repairs if borne by the company, and of the depreciation and interest charges thereon. Statements showing all costs, sale prices and rentals are to be filed with the Commission.

The decision provides special rates for breakdown, short-time and 10-to-7 service, etc.

MASSACHUSETTS.

The Massachusetts Railroad Commission has issued an order approving a change of route for the proposed Boston & Eastern Electric Railroad through the city of Lynn. The new route is by tunnel under Lynn Commons.

The plans for the road have been under headway for six years past. Considerable opposition developed, since the proposed road parallels two steam railroads and a suburban street railway. The Railroad Commission urged that if a road were built, it should enter Boston by a tunnel under the harbor. An act of the Legislature enabled the company to build the tunnel. The act requires that the tunnel be built without cost to the city of Boston, that it shall accommodate the traffic of other traction companies if any such company wishes to use it, and that it becomes the property of the city of Boston after forty years.

NEW YORK.

A report of gas and electric meter tests made for the Public Service Commission for the First District during the month of July shows that 28,869 gas meters were tested, of which 157 were tested on complaint, 23,675 were repaired and removed meters, and 5,057 were new meters. Twenty-six electric meters were also tested upon complaint. The tests of gas meters showed that 31.4 per cent were fast, 14 per cent slow, and 54.6 per cent correct within the two per cent allowed by law. Tests of the electric meters showed that 11.5 per cent were fast, none slow, and 88.5 per cent within the variation allowed, which is four per cent.

Iowa's Coal Production.

The total production of coal in Iowa in 1911 was 7,331,648 short tons, valued at $12,663,507.

Questions and Answers

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 86.—Voltage of Mining Locomotives.—What is the standard voltage for electric locomotives used in mines for the haulage of metallic ore? Would it be safe to use 500 volts on the trolley in a dry mine?—C. J. N., Sheridan, Wyo.

No. 87.—Origin of Indirect Lighting.—Where and when did the idea of indirect lighting originate? I have heard some people claim that it was in use by the ancients and others that it was devised only a few years ago.—B. E. S., Evanston, Ill.

No. 88.—Selenium-Cell Circuit-Closer for Street Lighting.—A short time ago I read that buoys can be automatically lighted at the approach of darkness by means of a selenium cell arrangement. Has this been used for closing street-lighting circuits?—J. R. W., Mackinac Island, Mich.

No. 89. — Compact Series-Multiple Switch for Heater.—Is there procurable on the market a compact series-multiple switch (not larger than an ordinary rotary snap switch) that may be used to connect the two parts of an electric heating element in series or in multiple so as to get a low and a high heat?—F. L. E., Lockport, N. Y.

No. 90.—Ozonator for Chemical Laboratory.—In a large chemical laboratory in a high school the pupils generally complained of the noxious gases. The room had a special ventilating equipment and special gas hoods in which chlorine, hydrogen sulphide, ammonia and other evil-smelling gases were supposed to be generated, but considerable quantities escaped into the room and were sometimes even blown into the main building when the wind was in a certain direction. Would a powerful ozonator have remedied this condition?—H. S., Peoria, Ill.

Answers.

No. 80.—Tumbler Switches.—I understand that "tumbler" switches are largely used in England for places where we would use push-button switches. How does this type of switch differ from our common rotary snap switches?—B. F., Aurora, Ill.

The tumbler switches in general use in England are quite different from our rotary snap switches. The movement is of the oscillating lever-switch type and is not rotary at all. The illustrations herewith show a typical and very popular switch of this kind; it is called the "Pivot" tumbler switch and is manufactured by A. P. Lundberg & Sons, London. Fig. 1 shows the switch with cover off, disclosing part of the mechanism. From Fig. 2 the action will be better understood; this is a side view with only one contact knife blade *A* shown. Both can be seen in Fig. 1 with the spiral spring *E* between them. The full lines of Fig. 2 show the switch in closed position; the dotted lines in open or "off" position. The actuating knob *B* protrudes above the cover. Oscillating it to the dotted position opens the switch. The knob is connected by the pin *C* to the peculiarly shaped contact arm *A*. This arm has a slot *F* that allows a variable leverage over the fixed fulcrum pin *D* on which it rocks. *G* is a hook on the arm *A* carrying one end of the spiral spring, the other end of which is fixed on a hook *J* that is formed out of the bridge on which the cover screws. Such switches are made in a great variety of forms for different service. They are all very easy to manipulate.—B. H. F., Maywood, Ill.

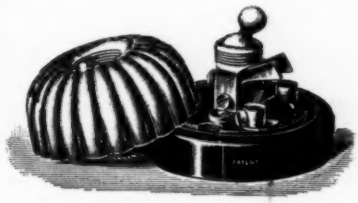


Fig. 1.—Pivot Tumbler Switch.

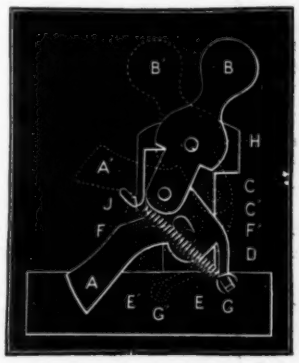


Fig. 2.—Operation of Tumbler Switch.

No. 82.—Insulation-Resistance Test of House Wiring.—What is the simplest and yet thoroughly reliable test of insulation resistance for the wiring in a large apartment house to determine whether it meets the strictest requirements of the National Code?—N. D. L., Oakland, Cal.

Ordinarily inspectors make no special test of insulation resistance in house wir-

ing. A telephone receiver and dry cell is commonly used to detect short-circuits or grounds and open-circuits. If the new wiring is in a very damp place, such as a laundry, brewery or packing house, the series-voltmeter test is used. This is very quickly and simply made and gives results of sufficient accuracy practically. This test can usually be made at the service switch, if a good ground (water pipe) is available nearby. The voltmeter is first connected across the switch to give the service voltage E. With all the lamp and other load-circuit switches open in the house, the voltmeter is next connected in series with one of the main supply leads of the house; the reading now obtained (E') should be extremely small, in most cases a person would call it zero. This reading is due to leakage of current through the insulation between the opposite sides of the house circuit. If this reading is relatively high, it shows there is a heavy leakage or partial short-circuit between the leads that must be removed. The resistance R_v of the voltmeter must be known; this is usually given inside the cover of a good portable instrument. The insulation resistance R can then be calculated from the formula

$$R = R_v (E - E') \div E'$$

Next the voltmeter is connected between one side of the house circuit and a water pipe or good ground. The reading obtained (E'') represents current leaking from the opposite side of the house circuit to ground. The resistance to ground can be calculated from the above formula also by substituting the new reading E'' for E'. If the supply does not involve a grounded neutral or grounded secondary, the test to ground should also be made from the other side of the circuit. These tests can be made in much shorter time than has been required to describe them. A good voltmeter of high resistance and easily read scale should be used. Its maximum reading range should be only a little over the service voltage used.—E. I., Detroit, Mich.

No. 83.—Quartz-Tube Mercury-Arc Lamps.—Have any of the new quartz-tube mercury-arc lamps that are coming into use in Europe been tried out for street lighting in this country? Can such lamps be purchased here?—B. V. S., Richmond, Va.

In the block on Randolph Street between La Salle Street and Fifth Avenue, Chicago, six quartz-tube lamps have been suspended 40 feet above the street for a trial installation. They are mounted on brackets from the fronts of the buildings and illuminate not only the street and sidewalk surface but the building façades as well. I understand that these lamps are rated at 2,500 mean hemispherical candlepower with 3.5 amperes on 220 volts direct current. The lamps are made by the Cooper Hewitt Electric Company, which has placed them on the market for industrial illumination as well as for street lighting.—A. P. G., Chicago, Ill.

No. 84.—Rotary Converters on Electric Locomotives.—Has the use of rotary converters ever been tried on electric locomotives for supplying current to direct-current traction motors from a high-voltage single-phase trolley line? Would not the better efficiency, weight and speed control of such motors make up for the small losses of the rotaries?—M. R. E., Hartford, Conn.

This method of operation has not been tried out to my knowledge, but a method quite similar was described in the Electrical Review and Western Electrician of June 22 of this year on page 1212. A Swiss locomotive is operating on a 12,000-volt 25-cycle single-phase line with 600-volt direct-current motors supplied through step-down transformers and a mechanical rectifier driven by a synchronous motor. The results are not given in detail, although an over-all efficiency of 80 per cent is claimed for the locomotive; great flexibility of control is also claimed. Such a system, whether using a rotary converter or mechanical rectifier is undoubtedly feasible but, in my opinion, not nearly as practical as the straight single-phase system. The equipment is certainly very much more complex and cumbersome and also decidedly heavier and more costly both as to initial and maintenance cost. I doubt the efficiency figure given. As to speed control the straight single-phase equipment gives a wide range of running speeds by means of variable-voltage taps on the transformer, thus dispensing with starting resistances. The operating characteristics of a single-phase rotary converter are not very good; this introduces a weak link in the chain of transformations required. At best a large amount of apparatus must be carried on the locomotives. To add to this another large rotating machine that is not absolutely needed is, to my mind, folly.—W. M. P., Hartford, Conn.

Water Powers of Green River.

The waters of Green River, the main branch of the Colorado, and its tributaries, while possessing large possibilities for the development of power, are practically unused except for irrigation. Theoretically it would be possible at the present time, according to the United States Geological Survey, by utilizing known storage sites, to develop about 1,500,000 horsepower in the basin of the Green. From Wells, Wyo., to the Wyoming State line, a distance of 225 miles, the stream has an average fall of 11 feet to the mile; and from the Wyoming State line to the mouth of Minnie Maud Creek, a distance of 200 miles, the average fall is 7 feet to the mile; the total fall is 3,875 feet.

Some Unique Electromagnets.

The discovery of electromagnetism by Hans C. Oersted in 1820 must be ranked among the discoveries which are of the greatest importance to modern industry. Applications of the electromagnet are to be seen everywhere and in the most varied forms. Almost all of the familiar forms of electric apparatus involve the use of an electromagnet. This applies to the telegraph, telephone, dynamos, motors, transformers, electric bells, annunciators, control apparatus of almost every form, etc.

The first electromagnet was made in 1825 by William Sturgeon in England. This form of magnet was further developed by Joseph Henry in this country, and he, in 1831, made two magnets, each of which would lift about 3,000 pounds, and was operated by a small battery. He also made a telegraph which could be operated from a distance, and even used an earth return, which has since become so common.

Since that time electromagnets have been made in all forms and sizes, and only a few of the more unusual forms can be mentioned here.

The magnet giving the strongest field which had been made up to that time was constructed in 1894 by H. DuBois, a professor in the University at Berlin, Germany. This magnet was constructed in the shape of a ring, around which the windings were uniformly distributed. This magnet enabled a field of 40,000 gausses to be obtained in the air gap, which was cut through at one portion of the ring.

The magnetic flux which can be obtained with any magnet depends upon the magnetomotive force and upon the reluctance. The magnetomotive force is proportional to the ampere-turns which link the magnetic circuit. It is sometimes expressed directly in ampere-turns and sometimes in gilberts, the gilbert being the unit in the C. G. S. system.

The reluctance of a magnetic circuit depends upon the material of which it is composed. Iron and other ferromagnetic materials have a small reluctance and consequently an intense magnetic flux can be created in them. The reluctance is inversely proportional to the permeability of the material. The permeability of air and most other substances is one, while the permeability of iron sometimes reaches values of many thousands.

The magnetic flux, which is obtained in any magnetic circuit, is directly proportional to the magnetomotive force and inversely proportional to the reluctance. The flux is measured in maxwells in the C. G. S. system, one maxwell being the same as what is sometimes loosely referred to as a line of force. The density of the magnetic

flux is expressed in gausses, one gauss representing one maxwell per square centimeter. The greatest flux-density which has been obtained in air is in excess of 40,000 gausses.

Professor DuBois later made a commercial form of electromagnet for intense fields in the shape of a half ring. This consisted of a base plate weighing 40 kilograms, and two arms in the shape of quarters of a ring, leaving a small air gap between their ends. Each of these arms was surrounded with four coils of wire, which, with the core, weighed 60 kilograms. There were altogether 2,500 turns of wire. This winding would carry 20 amperes and with all the turns connected in series required 70 volts for its operation. With pole pieces having flat circular faces with a radius of three millimeters, and with an air gap of one millimeter, a magnetic field could be secured in the air gap having a flux-density of about 40,000 gausses, the same as with the ring magnet. The self-inductance of this half-ring magnet was 180 henries. This magnet was made by Hartmann and Braun, Frankfort, Germany, and a smaller size of the same design weighing 25 kilograms is also available. The linear dimensions of the latter are about one-half those of the larger magnet. These magnets were constructed in 1899, and up to that time were the most powerful electromagnets on the market.

By increasing the magnetomotive force which is applied to a magnet of appropriate shape, it might seem that there would be no limit to the strength of the magnetic field which could be produced. Practical difficulties, however, limit this, as the heat generated in the magnetizing coils, if too large a current be used, causes difficulties. In order to overcome this objection a magnet was designed by Pierre Weiss, professor in the Polytechnic School of Zurich, Switzerland. In this magnet the copper coils which surround the core are immersed in an oil bath in which is a coil of pipe carrying a stream of cold water, so that the heat is carried off as fast as it is generated (see Fig. 1).

The yoke of this magnet is of extra soft steel bent twice at 90 degrees, and to this are connected two cylindrical cores of the same material. These cores are 15 centimeters in diameters and 52 centimeters long. The yoke is 12 by 21 centimeters, and, consequently, has a cross section of 252 square centimeters (4 square inches). The cross-section of the cylindrical cores is 176.7 square centimeters (2.8 square inches). The weight of these cores is 70 kilograms. The coils are fixed in position, but the position of the cores can be adjusted by means of a screw so as to fix the air gap at any desired value. Pole pieces 13.5 centimeters long and tapered are attached to the cores. The copper conductor consists of strips 15 millimeters wide and one millimeter thick, wound in a spiral, with an insulation between turns 0.2 millimeter in thickness. Each coil contains 15 spirals 3.5 millimeters apart, and each spiral contains 112 turns. The total number of turns on the magnet is, therefore, 3,360. When the maximum current, 60 amperes, is flowing, this gives 201,600 ampere-turns. The resistance of the winding when cold is 4.9 ohms and this is not increased more than five per cent by heating. About 300 volts are required to give the maximum excitation, which, consequently, requires about 18 kilowatts. In most of the experiments for which the magnet is used, however, 25 amperes is sufficient, the consumption then being only three kilowatts. If a current of 50 amperes through this coil is suddenly broken, an arc 20 centimeters long is produced, owing to the high inductance of the circuit. As there is, of course, a possibility of this happening at any time, the oil insulation has an additional advantage in preventing the breakdown of the winding from this cause.

The total weight of this magnet is about 1,000 kilograms. It is mounted on a pivot, so that it may be oriented in any position, the motion being controlled by means of a tangent screw.

With 53 amperes flowing in the magnetizing coils and an air gap of 1.95 millimeters (0.0768 inch) and pole pieces of the best extra soft steel, a flux-density was secured in the air

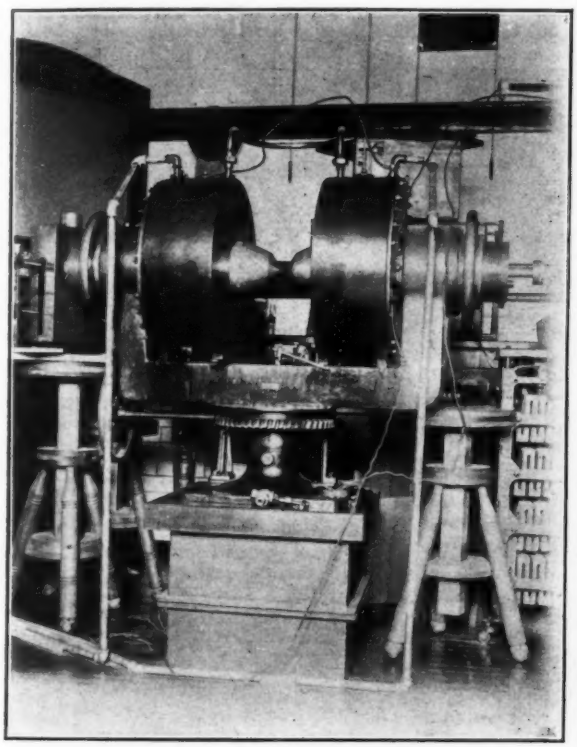


Fig. 1.—Weiss Magnet at Bureau of Standards.

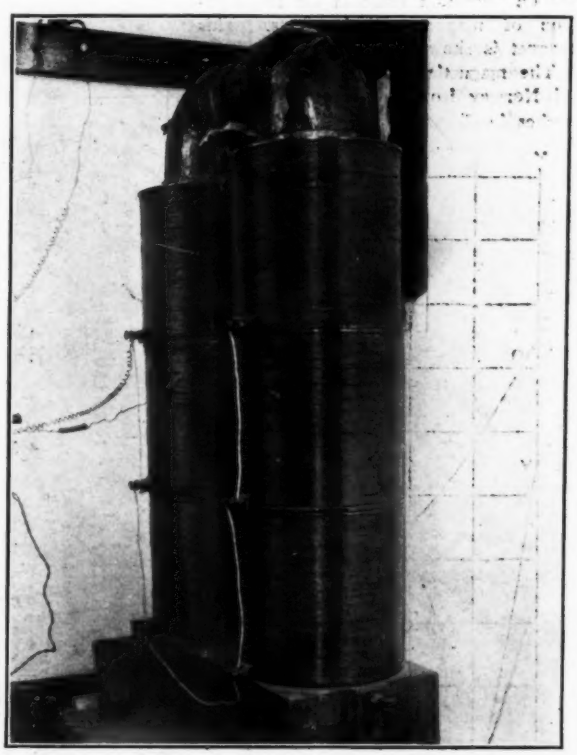


Fig. 2.—Brace Magnet at University of Nebraska.

gap of 46,250 gausses. With pole pieces of Swedish iron the flux-density was 45,900. By reducing the air gap slightly, a flux-density as high as 46,750 gausses was secured. The maximum intensity of magnetization in the iron was 1,850 C. G. S. units.

This magnet was constructed at the Oerlikon works. A duplicate of the original magnet was made for the Bureau of Standards, Washington, D. C. This is illustrated in Fig. 1.

One of the most powerful electromagnets which has been constructed in this country is that designed by the late D. B. Brace and constructed for use in the Physical Laboratory at the University of Nebraska, where Professor Brace carrid on important work in the investigation of magneto-optical effects. This magnet is shown in Fig. 2.

The magnetic circuit was constructed of Norway iron, the cores being eight inches in diameter and surrounded with six magnetizing coils of No. 10 copper wire. These could be connected in any desired combination. The weight of the copper in these coils was about 650 pounds, and the total weight of the magnet about 4,000 pounds. Its height was about four feet. A variety of pole pieces was available, giving areas of pole face up to 96 square inches.

With pole faces measuring 2.5 inches square and an air gap of 2.09 inches (5.3 centimeters) a strength of magnetic field of 8,700 gausses was obtained by using 100,000 ampere-turns. With conical pole pieces having a circular pole face of diameter 0.7 inches and an air gap of 0.1 inch (2.5 millimeters), a flux-density in the air of 38,000 gausses was secured by using 66,000 amperes-turns. This current was kept on for two hours without undue heating. With the air gap increased to 0.25 inch (6.5 millimeters) a field of 30,000 gausses could be maintained indefinitely with 40,000 ampere-turns.

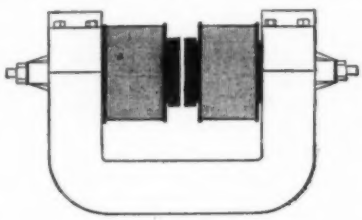


Fig. 3.

This notable magnet is still in use in the new Brace Laboratory of Physics under the direction of C. A. Skinner, who is now the professor of physics.

Some of the most notable experiments in magnetism which have been made in this country have been performed by B. O. Peirce, professor of natural philosophy in Harvard University. One of the magnets used by Professor Peirce is represented in Fig. 3. This magnet has a frame of cast iron with a rectangular cross-section 20 by 40 centimeters (8 by 16 inches). The magnet cores are of soft steel and are cylindrical in shape with a diameter of about 10 inches. They fit very accurately into sockets in the frame. The pole pieces shown in the figure are 1.75 inches thick. The exciting coils contain 2,823 turns and have a resistance of about 12.4 ohms. The total weight is 3,300 pounds. This magnet was designed by A. W. K. Billings to give a nearly uniform field of about 18,000 gausses throughout the whole air gap between the pole pieces.

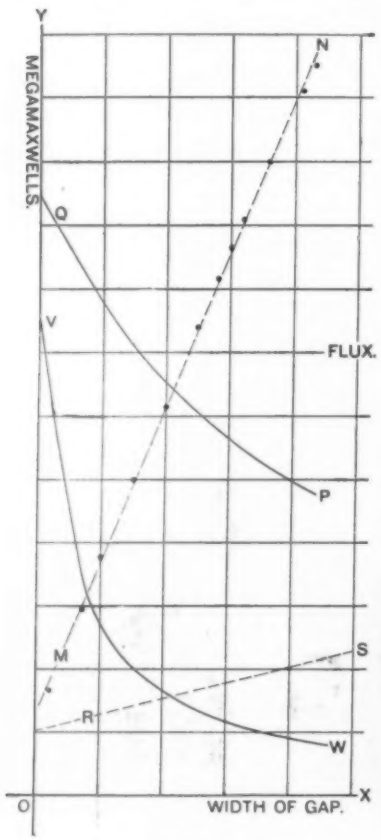


Fig. 4.

Fig. 5.—Removing Iron Particles From the Eye.

The curve *VW* in Fig. 4 shows the total flux across the air gap when the excitation is about 5,700 ampere-turns. One division measured horizontally in this figure represents one centimeter and one division measured vertically represents 1,000,000 maxwells. The line *MN* is plotted from values which are proportional to the reciprocal of the total

magnetic flux, and this is seen to give a line which is nearly straight.

With an excitation of 28,500 ampere-turns, the total flux for different air gaps is shown by the curve *PQ*. The line of reciprocal value in this case is *RS*, which also appears to be a straight line. The fact that the lines *MN* and *RS* are straight is not a general condition for all magnets, but one which is peculiar to this magnet and depends upon the arrangement of the exciting coils on the core. The magnetic flux, which is considered in plotting these curves, includes only that which is between the pole faces and not any outside of this space.

This magnet is supplied with two conical pole pieces giving a flat pole face with a diameter 0.57 inches (14.5 millimeters). With an air gap of 0.0545 inch (1.38 millimeters), the following values of the flux-density in the air gap were obtained.

Flux-Density in Gausses.	Approximate Number of Ampere-Turns.
33,900	22,600
39,300	56,500
41,400	76,200
42,200	98,800

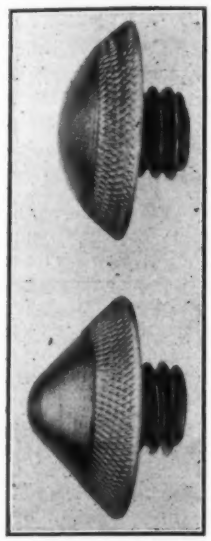


Fig. 6.

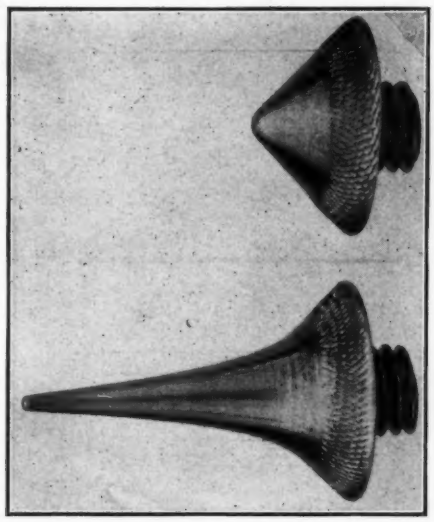


Fig. 7.

With a somewhat narrower gap and excitation of about 127,000 ampere-turns, the measured flux-density in the air gap was 43,160 gausses.

The shape of the pole pieces here used was intended to give a uniform field and not maximum concentration. A more intense local field could have been produced with pole pieces having a sharper angle. It is to be noted that the area of the field here measured was more than 114 square millimeters. The excellent design of a magnet which will give such an intense field is made evident by the following quotation from DuBois's "Magnetic Circuit in Theory and Practice," where it is stated: "A ring electromagnet of manageable size, with truncated conical pole pieces of 120 degrees aperture, enables us to have fields up to, say, 40,000 C. G. S. units over an extent of some square millimeters. To exceed this to any material extent could at present be only accomplished by an undue expenditure of means out of all proposition with the end in view."

Electromagnets of various forms have been used for some time past in order to remove particles of iron from the eye. Professor Haab, of Zurich, Switzerland, has designed a new type of eye magent which is intended for physicians' use and has a number of improvements in its makeup, so that it is likely to be of better service in these very delicate operations than the ones which have been heretofore used. It is shown in Fig. 5. Dr. Haab finds that a magnet of this kind needs to have the greatest possible force in order to draw deeply imbedded iron particles out of the eye. It should also be mounted conveniently in a horizontal position and have a foot switch so that the current can be applied while the operator is using his hands to manipulate the eye. Then the magnetic points must be of the right shape to suit the kind of operation which is carried out, and interchangeable pole pieces should be provided. Surgeons have sometimes found that a weak magnet fails just at the critical moment of the operation, and is not strong enough to draw out the iron particle, so that for this reason the present magnet is of a very powerful design. It is mounted on an iron column, with a shelf for placing the patients' arms in the best position. The magnet is designed so that the pole point is not too long to be strong and at the same time magnet body does not hide the field of sight from the operator. Four forms of pole pieces are provided as shown in Figs. 6 and 7. The

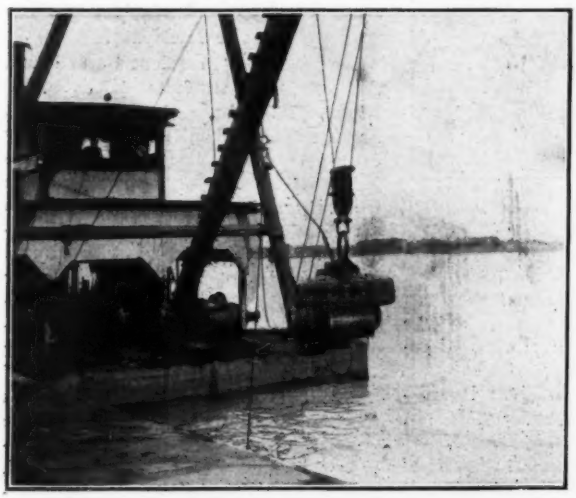


Fig. 8.—Salvaging Nails from the Mississippi River.

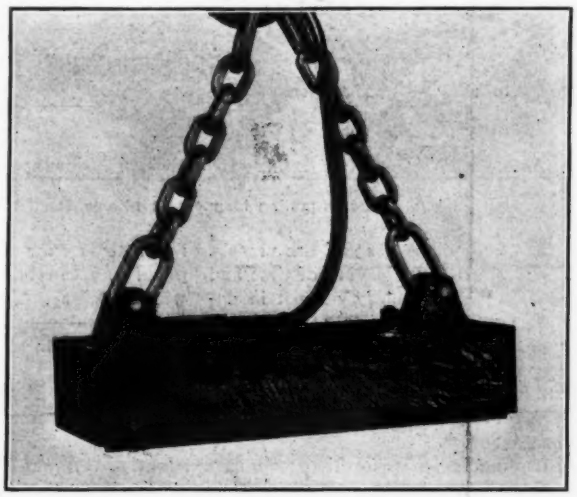


Fig. 9.—Rectangular Plate Magnet for Handling Hot Billets.

other pole of the magnet is bell shaped. This apparatus is made at the Oerlikon Works.

This magnet exerts a greater force than any other which has been designed for this purpose. The coils of this magnet can be wound for voltages from 60 to 300 volts and the maximum power consumed is one kilowatt. The total weight of the apparatus is 286 pounds.

One of the most important applications of electromagnets in industrial work is for lifting large masses of iron and steel. The lifting magnet has probably had a greater influence in reducing the cost of handling iron and steel than any other apparatus, except the traveling crane, with which it is, of course, used. The lifting magnet is used for handling pig iron, scrap, castings, billets, rails, and plates; for handling skull-cracker balls and for loading and unloading cars and ore vessels. It results in a great saving of time and labor, and consequently of cost in doing the work. The installation of lifting magnets by the Carnegie Steel Company enabled two men to do the work formerly requiring 25 laborers, and altogether 28 men took the place of 350 laborers.

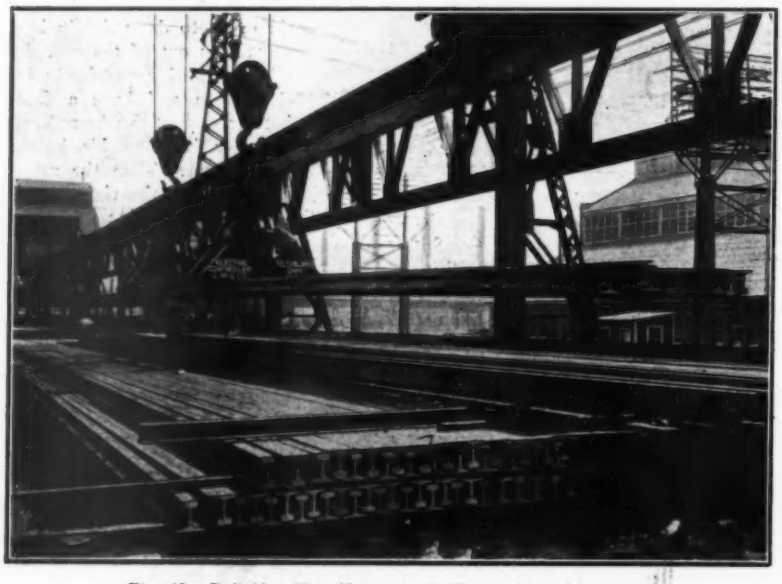


Fig. 10.—Rail-Handling Magnets at Illinois Steel Company.

In unloading a steamship at Indiana Harbor, Ind., carrying 4,000,000 pounds of pig iron, unloading was accomplished by means of a lifting magnet in 10 hours and 30 minutes. Two operators did this work, with the assistance of two laborers for part of the time. Under the old methods of unloading, two days and two nights would have been required for this work, with the services of 28 men.

Lifting magnets are usually circular in shape, one pole being formed at the circumference and the other near the center. The coil carrying the current is placed between the two. Such magnets are made in sizes up to 62 inches in diameter. The weight which may be lifted depends upon the shape and character of the material. One thousand pounds is an ordinary lift for one of these magnets, but under favorable conditions as much as 30 tons can be lifted.

One curious use which has been made of these lifting magnets is to salvage a cargo of magnetic material which had sunk in deep water. The first application of this kind was in the Mississippi River at New Orleans, where a barge loaded with 1,500 tons of wire nails, hoops, etc., sank in 35 feet of water. Fig. 8 shows the lifting magnet in the act of raising several kegs of nails from the bottom of the river. The construction and insulation of these magnets is such that they are waterproof and can be used for such work without injury. The magnets shown in Figs. 8 and 9 are both made by the Cutler-Hammer Manufacturing Company.

The magnet shown in Fig. 9 is a rectangular plate magnet 14 by 36 inches, which is used for handling hot billets slightly below a red heat. The winding of this magnet is covered with asbestos insulation and is thus fireproof.

Magnets similar to the above are made by the Electric Controller & Manufacturing Company. This company makes a magnet somewhat similar to that shown in Fig. 9, which is 66 by 29 inches in size. Another unique form of lifting magnet made by this company is designed for handling 60-foot rails and is shown in Fig. 10. It consists of two magnets mounted at the end of a beam. Nineteen rails weighing 30,400 pounds were lifted at one time, and more than this number have been included in a single lift.

Electric Furnaces at Essen.

Messrs. Krupp, at Essen, Germany, took up the manufacture of electric steel in the year 1908, and installed two Frick furnaces of 11 tons each maximum charge and a 12-ton Girod furnace. The Frick furnaces are of the induction type and contain an iron circuit, arranged similarly to an ordinary transformer. The primary circuit consists of two coils suitably placed above and below the steel bath, supplied from a power station with a five-cycle alternating current of 5,000 volts and 360 amperes, the maximum power obtainable being 950 kilowatts. The secondary circuit is the bath itself. The bath voltage amounts to 15 volts for a current strength of about 120,000 amperes.

The Frick furnaces are charged by hand with cold material, specially selected with a view to the quality of the steel to be produced, in the same way as obtains in the crucible process. A complete heat takes from five to seven hours, according to the weight of the charge. The power consumption per ton of high-quality steel produced amounts to about 500 kilowatt-hours.

For many specialties the Krupp Works prefers using crucible steel rather than electric steel, although the cost of production of crucible steel is higher than that of electric steel.

Bust of Joseph Henry Presented to the Institute.

Through Past-President Gano Dunn, the American Institute of Electrical Engineers has been enabled to add to its historic collection an admirably executed bronze bust of the distinguished scientist, Joseph Henry, taken from the life-size statue of Henry in the Smithsonian Institution at Washington. The Institute, at its annual meeting last May, presented a similar bust to the Associazione Elettrotecnica Italiana, as an evidence of its appreciation of the cordial hospitality shown by the officers and members of the Associazione to the representatives of the United States attending the meeting of the International Electrotechnical Commission at Turin last fall. At the directors' meeting held in Boston during the annual convention in June, a letter was read from President Dunn asking the permission of the Board to present this bust to the Institute, which was granted.

The bust, which has recently been received at Institute headquarters, as well as the one presented by the Institute to the Italian society, were reproduced under the supervision of the distinguished sculptor of the original, Herbert Adams, of New York City.

INDUCTION-MOTOR DRIVE IN PLANING MILLS.

By John Liston.

The maximum production obtainable with any planing-mill equipment is vitally affected by the system of power application adopted, and the records of economical operation which have been secured in numerous electrically driven mills have served to concentrate the attention of operators on the details of power plant, current distribution, motor drive and methods of control.

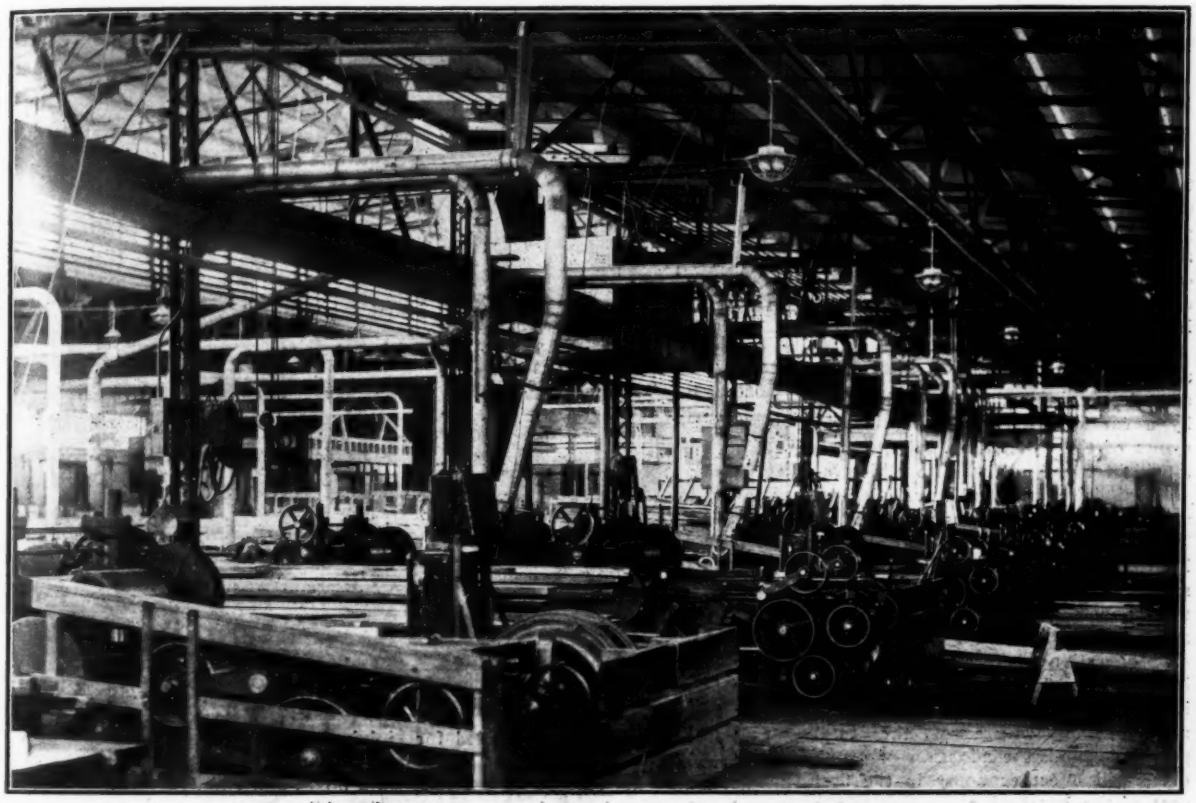
The question as to whether alternating-current or direct-current motors should be used in any particular plant must be governed largely by the character of the work performed, but as a rule unless a large percentage of the machinery requires variable-speed operation, alternating current should be selected, as both generators and motors are somewhat simpler in mechanical design than for direct current, and are better adapted to conditions where flying dust is encountered. In general, the requirements of planing-mill operation can be met successfully by constant-speed motors and the simple squirrel-cage type of polyphase induction motor can be most advantageously used, as the working conditions in planing mills permit the motors to be started in most cases under light loads, thereby tending to minimize the current demand on the power station when putting the motors into service. Any necessary demand for variable speed can be readily met by one of the several forms of pole-changing multispeed induction motors which are now available, and which at speeds below normal will give a proportionally reduced output with good efficiency.

By utilizing induction motors for all power applications, the generating and distribution systems will be reduced to their simplest form, and the expense of motor-generator sets and complications in the current-distribution system, which would be entailed where both alternating and direct-current motors were used, are thereby obviated. The absence of moving electrical contacts and the extreme simplicity and strength of the rotating element of the induction motor conduce to the reduction of the fire hazard, and as the compensators and controllers are totally inclosed, the practical elimination of danger from the electrical equipment may be secured by running all wiring in iron conduit and mounting all fuses in closed metal boxes.

Owing to the nature of the work performed in planing mills, the load on the motors is intermittent and subject to wide variations, and therefore, in order to obtain maximum efficiency for the electrical system when induction motors are used, careful attention must be given to the question of power-factor. This type of motor when lightly loaded will operate at lagging power-factors, which may seriously diminish the effective capacity of both generators and conductors, and at the same time have an adverse effect upon the voltage regulation.

In the case of large planing mills the use of synchronous motors operated at partial loads or simply floated on the line to serve as phase modifiers can be advantageously adopted to improve the power-factor of the system, and this method is of especial value if the power station is located at a distance from the mill. Where this course is not economically feasible, the power-factor of the system may be maintained at a relatively high value by a careful selection of the size of motors applied to the various machines, as the induction motor when fully loaded will give a power-factor from 85 to 90 per cent.

The horsepower ratings given by the machinery manufacturers should be carefully checked by temporarily applying a motor to each type of machine, and connecting instruments in the motor circuit so that the actual current demand of each machine or



Battery of Planers With Individual Motor Drive—Paine Lumber Company.

group, under different working conditions, may be accurately determined.

It should be borne in mind that every planing mill has certain conditions peculiar to itself, and that the rating of a motor doing any given work in one locality may not form a proper basis for estimating the motor capacity required for similar work with different materials, but by ascertaining the power demand for the various machines as outlined above, the necessity for changes in the motor equipment, after the plant is in operation, will be avoided, and by taking advantage of the overload capacity of the induction motor when the peak demand covers short intermittent periods, motors for all applications can be provided at such predetermined ratings as will result in maximum operating efficiency at the highest practicable power-factor.

The constant-speed characteristic of the induction motor when operating under wide fluctuations in load renders possible a close approach to a uniform rate of production at the maximum capacity of the machinery, and experience has shown that it also tends to improve the quality of the product.

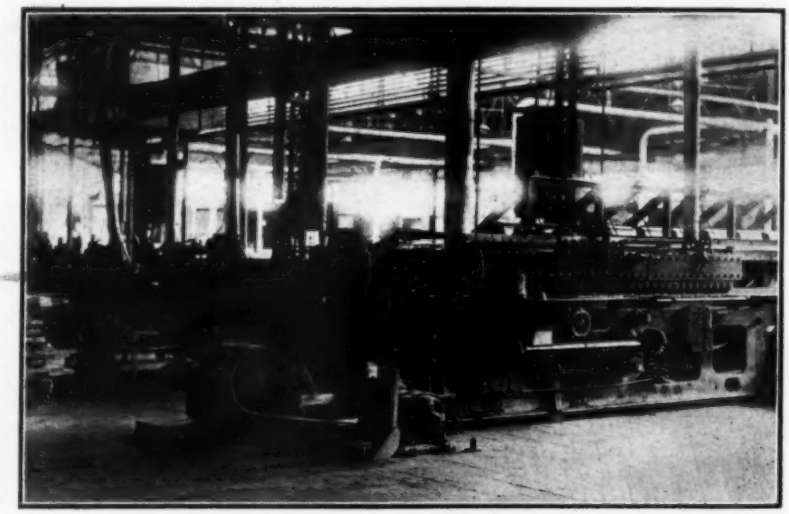
The relative advantages of group and individual drive for planing mills must be determined in every instance by a careful analysis of the requirements of the installation. In general, it will be found advisable to utilize individual drive for band saws, planers, matchers, edgers, sizers, etc., while blowers and conveyors should also be individually driven. For batteries of small auxiliary machines where the total power demand is comparatively small, or for tool-room and machine-shop operation where the power losses in belting and shafting will, due to intermittent operation, constitute a negligible percentage of the total power demand, the adoption of group drive will effect economy in the first cost of the installation.

The modern planing mill, as a rule, adopts individual drive for the main machines, and the various auxiliaries are divided into small groups with motors so located as to give a central drive on comparatively short countershafts. An excellent example of both power-station and planing-mill equipment is found in the plant of the Paine Lumber Company, at Oshkosh, Wis., from which the accompanying illustrations are taken. This company is the largest manufacturer of venered doors in the world, and the newer mill buildings at Oshkosh are equipped with electric drive throughout, there being a total of 315 motors, all of the three-phase, 60-cycle, induction type. The planing mill utilizes 113 motors, nearly all of which are applied individually.

The power station consists of an isolated plant containing two high-pressure turbo-alternators, one rated at 1,000 kilowatts, and one at 500 kilowatts, 480 volts. These turbines are mounted on concrete foundations, which are isolated from the power station floors to eliminate vibration in the building. Excitation current is supplied by means of an engine-driven exciter and a motor-generator set.

The switchboard equipment comprises a nine-panel main board, and a five-panel station board, with the oil switches mounted back of the boards. The main switches are all electrically operated, and pilot lights are provided on all main and feeder circuits.

The main current distribution is effected through two underground feeders utilizing 2,000,000 circular-mil conductors, one feeder serving the planing mill, and the other the "odd" shop.



Linderman Dovetailer Driven by Two 7.5-Horsepower Motors.

Lighting throughout is provided for by clusters of 60 and 120-volt incandescent lamps, but current for the motors is distributed at the generator voltage, all the motors used in the mill being rated at 440 volts. In the yards, however, there are two transfer tables, each driven by a five-horsepower motor and provided with a winch separately operated by a two-horsepower motor. There is also a yard locomotive driven by a 75-horsepower motor. These motors are all three-phase, wound-rotor units provided with collector rings and external resistance. Current is distributed to them by a double trolley and bonded rail, and as they operate at 220 volts they are supplied from the power station through three 10-kilowatt, 440/220-volt, single-phase, delta-connected transformers.

In the planing mill every precaution has been taken to minimize the fire risk, and the wiring for the mill enters through the floor and runs directly to a building switchboard, from which point it is carried to heavy, sheet-iron junctioin boxes located near the motors; all feeder-circuit fuses being inclosed in these junction boxes. All large motors are operated through compensators, and additional fuses are mounted in the bores above each compensator, as shown in some of the accompanying illustrations. The building wiring throughout is carried in conduit.

The mill equipment contains a large percentage of individually driven machines and a few small groups operated through belts. This mill handles birch, oak, elm, hemlock, pine and basswood, which is largely of the Paine Lumber Company's own sawing.

A large part of the output is devoted to the manufacture of veneered doors, which is carried out in the adjoining "odd" shop. There are also manufactured, annually, about five million boxes and twenty-five million feet of molding.

The planer outfit comprises ten double-head units, ranging in size from 15 inch to 30 inch, each driven by a 35-horsepower motor, six of these being direct-connected to the driving shaft through flexible couplings, while the remaining four are belt-driven. There are also three pony planers, one 24 inch and one 30 inch, each belt-driven by a 7.5-horsepower motor, while the third unit is a double-head machine, utilizing three 7.5-horsepower motors, two of which drive the top head, and the third the bottom head,—all motors driving through belts.

The battery of rip saws includes 12 five-gang units, each belt-driven by a 50-horsepower motor; four single rips, each driven by a 20-horsepower motor, and 29 slashers, each utilizing a three-

horsepower motor, all these saws being belt-driven.

Silent chain drive is used for the five band saws in the mill, three of these being 8 inch, with 50-horsepower motors, the remaining two being 4 inch, each driven by a 35-horsepower motor. In addition to the regular planing mill equipment, there is a battery of 15 molders, ranging in size from 6 inch to 12 inch; one of these is individually driven by a 15-horsepower motor, the others being operated in small groups by motors ranging from 15 to 25 horsepower—all belt-connected. There is also a 15-inch, 6-knife head molder, which is direct-driven by a 35-horsepower, 1,200-revolutions-per-minute motor. Among the auxiliaries are a broom-sander, driven by a 7.5-horsepower motor, and a 24-inch drum sander, driven by a 35-horsepower motor.

In the box department of the mill individual drive has been used throughout for the operation of saw trimmer, hand-feed rip saws, bundle cutter saw, printing machines and box nailers, the motors used ranging from 3 to 35 horsepower in capacity.

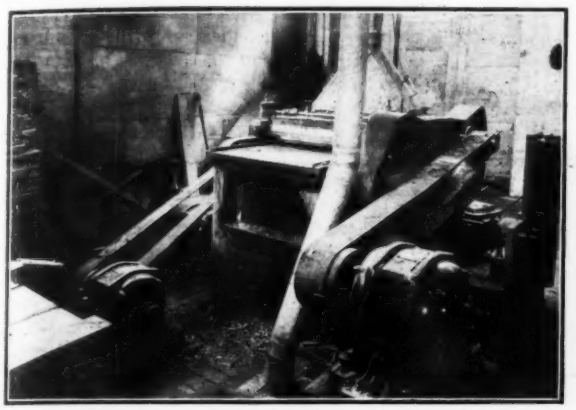
The planing-mill machinery also includes two Linderman dovetailers, each driven through belts by two motors.

For the blower system there are four 80-inch units, two of them driven by 35-horsepower, and two by 50-horsepower motors, direct-coupled to the blower rotors. These blowers deliver shavings and sawdust to the boiler at the power station, while the waste wood is carried by a 10-horsepower motor-conveyor to one end of the mill, where it is collected for sale locally.

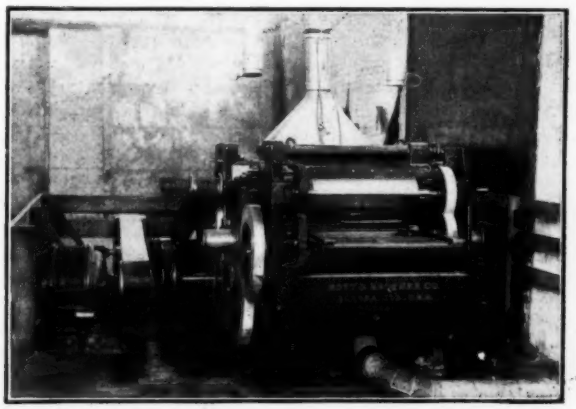
For grinding and jointing the planer knives, without removing them from the machines, seven special grinding sets have been provided, each driven by a 1-horsepower motor, which is permanently mounted on an overhead beam and serves two machines, the grinding rig being driven through belting having an adjustable counterweight to insure uniform belt tension. In addition, the grinding facilities include a six-wheel, single-spindle set with small wheels of the usual type, and two 36-inch knife grinders, driven respectively by 2-horsepower and 3-horsepower motors.

In spite of the fact that no synchronous motors are used and the load on the power station is almost entirely inductive, the ratings of the motors adopted have been so carefully selected that the power-factor of the system is maintained at about 74 per cent under average working conditions. In order to protect the motors from accumulations of sawdust they are covered with sheet-metal boxes, which are readily removable; compressed air being utilized to clean the motors each week.

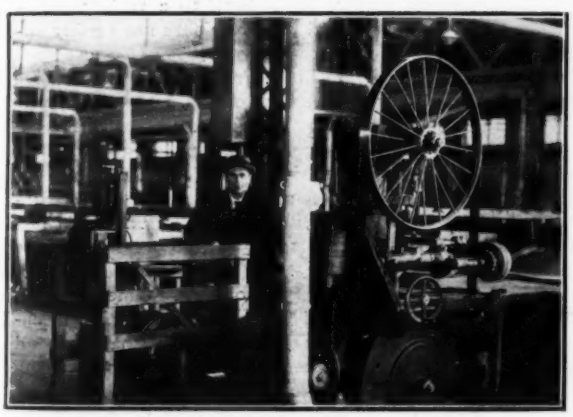
The motors in this installation were supplied by the General Electric Company, from whose bulletins much of the information here given has been taken.



26-Inch Double-Head Planer Driven by Three Motors.



35-Horsepower Induction Motor Belted to 26-Inch Double Planer.



35-Horsepower Induction Motor Driving Four-Inch Band Saw Through Silent Chain.

Two Blowers, Each Direct-Connected to 35-Horsepower Motor.

Industrial Building Completed.

The Industrial Building, which was opened in Baltimore, Md., for the purpose of furnishing small manufacturers with adequate accommodations and facilities for carrying on their business without a large investment, was described in our issue of September 9, 1911.

This building was formally opened on July 24 with a speech by J. E. Aldred, president of the Consolidated Gas, Electric Light & Power Company and of the Pennsylvania Water & Power Company. It was at the suggestion of Mr. Aldred that the building was erected and the two power companies are part owners.

THE SELECTION OF AN ELECTRIC FAN.[1]

By H. M. Scheibe.

Fan motors are so generally used and operate with so little attention that it is commonly thought that all fan motors are more or less alike and that little care is needed in their selection. Examination, however, of the various fan motors on the market indicates that there exists a wide difference, not only in fans of different manufacture but at times between different sizes and models from the same factory. The selection of a fan is made by two classes of purchasers, namely, the dealer who purchases in quantity from the factory and the user of the fan. As it is usually to a dealer's advantage to handle one line of fans exclusively, it follows that he should make his selection of that line with due regard to the customers' requirements. The following description will therefore treat the subject only from the standpoint of the user.

As in the case of larger apparatus, a fan motor should be selected with a view to the service which it is to perform as well as its initial and ultimate cost, and the service requirements should govern as to the size and type which is chosen. Portability, durability, cool running and adjustability should be insisted on. Neatness of appearance, and variety of finish will also appeal to the purchaser, especially when the fan is for use in the home.

The item of first cost ordinarily enters but slightly into the selection of an electric fan as the prices of small fans of different manufacture are approximately the same. A slight difference in price should not, moreover, be given too great consideration as it may be that the more efficient fan will easily save the difference in price during a single season. Usually the one question which arises at this point is whether the fan should be purchased. For residence purposes this is simply a question of whether the convenience is worth the price. For office or factory use the question of greater efficiency of the workers on account of more comfortable surroundings is the determining factor.

Operating Costs.—A few years ago fat motors were crude, clumsy and inefficient affairs, but active development by the various makers has resulted in great improvement. There still exists, however, sufficient variation to make a difference in operating costs in some cases of as much as ten per cent of the first cost of the fan during each season. This saving represents a good investment of the time required to make a careful selection. It is worth while for dealers to check up the power consumed both by the fans they handle and also by fans of other types. No special apparatus is necessary to make imput tests other than a low-reading wattmeter and a voltmeter. It is, of course, evident that all fans which are tested on the same circuit should be of the same rated voltage, as a fan which is designed for a lower voltage will take a larger current and deliver a greater volume of air than a fan built for a higher voltage.

Air Delivery.—It must not be assumed that a fan with low current consumption necessarily delivers less air than one with a larger input, as a wide difference will be found, both in the efficiency of fan motors and in the efficiency of blades of different designs. A final judgment of a fan performance involves, of course, checking its air delivery against the power it consumes. Absolute air measurements cannot be made without special equipment and elaborate tests—and are at best of little interest to the fan user who is concerned only with comparative results. It is easy, however, to select the better of two fans in point of air delivery by either of two simple methods that can be used almost anywhere. It is suggested that dealers in fans will find it to their advantage to be in a position to make these simple tests at any time, not only in order to select the best fan to handle, but also to be fortified with first-hand information on the apparatus that they sell.

The first test consists in placing the fan so that it will deliver a current of air exactly in a vertical direction. It should then be weighed on any ordinary scales graduated to ounces, first with the fan running at full speed and again at a standstill. The difference in ounces represents the thrust with which the fan propels the air. Obviously only fans of the same blade diameter and same rated voltage should be used.

Another method, which is somewhat more direct, consists in placing the two competing fans face to face, about six inches apart, with the shafts in line with each other both vertically and horizontally. A piece of cardboard large enough to more than cover the whole face of the fan blades is held loosely by the top edge midway between the blades. With both motors running at full speed the card will swing toward the fan with the smaller air delivery. Care should be taken that the card is held midway between the blades and not necessarily midway between guards.

It is evident than an electric fan which is used for cooling purposes should not become excessively warm itself. Practically all fans on the market will operate continuously at a temperature very much below that required to injure the insulation. Other things being equal, a fan of lower operating temperature should be selected, as low temperature means low losses in the motor or a large current of air passing the motor, both of which features are desirable.

Noise.—A certain amount of humming is involved in the operation of any electric fan. Where slight noise is not objectionable and maximum movement of air is desired the ordinary four-bladed fan is to be recommended. If quietness is the prime consideration a six-bladed fan running about two-thirds as fast should be selected. All of the leading fan makers now offer such a fan for residence use. A great deal of difference exists in this respect, however, between different makes of fans, as by properly shaping the blades some manufacturers have been able to secure much more quiet operation than others without sacrificing air delivery.

Ready portability of a fan is obviously desirable. This means that it must be light of weight without sacrificing stability, and sufficiently rugged to withstand careless handling and carrying by the guards. A marked advance in portability has recently been made by the introduction of pressed-steel motors. This construction has obvious advantages in point of light weight, neatness and ruggedness. At the same time, the smooth, close-grained metal surface lends itself to a variety of ornamental plated finishes not readily applied to cast iron.

Durability.—Practically all of the large manufacturers of fan motors are now marketing apparatus that will operate satisfactorily under long continued periods of service. Probably no other class of rotating machinery receives less care and gives more uniformly satisfactory service than does the average fan motor. This statement is not necessarily true, however, of mechanically oscillated fans, as the oscillating mechanism necessarily involves a gear and link system, and the various types on the market differ widely in durability and in the facility with which wearing parts may be replaced. A link system that involves a long series of pin joints is very liable to develop lost motion rapidly and this makes the oscillation short and unsteady, when the mechanism begins to wear. Gears should be few in number and readily replaced without using tools other than the ever present screwdriver.

All fan motors should be given periodic cleaning and lubrication, although many of them seldom get it. This is very important if long and satisfactory service is expected.

Adjustability.—Convenience demands

[1] From *The Electric Journal.*

that a desk fan be readily adjustable as to direction of air delivery and speed control.

The fan should always be stable on the desk when pointing in any ordinary direction, and it should be capable of being mounted on the wall if desired without using extra parts or tools. In the case of oscillating fans it is convenient to be able to start or stop the oscillation without stopping the motor.

Inasmuch as some of the foregoing considerations are to a certain extent conflicting, it is necessary to decide which features are of paramount importance. Thus too low first cost is not compatible with highest quality. Effective air delivery is difficult to secure without a certain amount of noise. There is no reason, however, why neatness of appearance, light weight, etc., should not be combined with low power consumption and adequate air delivery.

A fan motor should be selected to suit the service conditions just as much as a large piece of apparatus. For instance, a sixteen-inch fan delivers a big breeze sufficient to circulate the air in a large office, but most fans of this size, when running at high speed, are entirely too noisy for use in a house or quiet private office. A twelve-inch fan is usually adequate to any demand of house service, and several makers are marketing a special six-bladed slow-speed fan of this size especially for residence use where noise is very objectionable. The eight-inch fan is also largely used as a residence fan, as it is very easily carried about and entirely adequate where large volumes of air are not needed.

Stimulating the Demand for Electric Flatirons.

The central-station company at Manchester, N. H., made a striking window display of its entire stock of 200 electric flatirons at the opening of its flatiron campaign this year. The irons were piled up in the form of a pyramid in the window of the company's office. Newspaper advertising and house-to-house soliciting were invoked and attention called to the window display. As the irons were sold they were taken from the stock in the window which rapidly decreased with the increasing demand. This aroused so much interest that at the end of one month over 500 irons had been disposed of.

Arizona Copper.

Arizona remained, in 1911, the leading copper-producing state, increasing the production from 297,491,151 pounds, valued at $37,781,376, in 1910, to 306,141,538 pounds, valued at $38,267,692. Increases in Pinal and Gila Counties more than offset a large decrease in Cochise County.

DIFFERENTIAL REGULATION.

By E. E. George.

The accurate variation of quantities is probably more useful in the field of electrical measurements than in any other. The following is a novel, and in many cases, extremely valuable method of getting known small variations in practically any electrical quantity.

About the only well known application of a differential mechanical movement is that of the chain hoist. The most obvious application of the principle to elec-

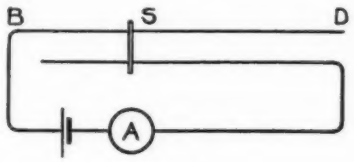


Fig. 1.

trical measurements is a differential Wheatstone bridge. Consider two parallel, homogeneous resistance wires of equal length stretched on a base-board. (See Fig. 1.) Let their diameters—and, therefore, their resistances—be slightly different. Connect a battery and ammeter as in the diagram to the ends of the wires.

As the slider S connecting the two wires is moved from B to D, the total resistance in the circuit is varied by the difference in the resistance of the two wires. This difference can be made as small as de-

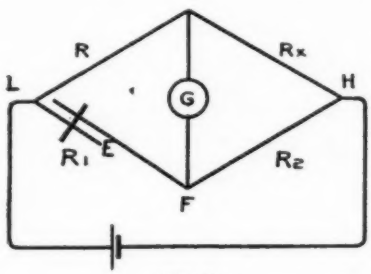


Fig. 2.

sired. S may be moved only a small fractional part of the length BD, thus changing the resistance of that fractional part of the difference in the resistances of the two wires. The possibilities of this method are sufficient for even a standardizing laboratory. There is no limit to the minuteness of variation possible. The control of resistance may be brought within the percentage of accuracy of any instrument.

Consider a slide-wire bridge, (Fig. 2,) with the usual slide wire EFH (point of contact, F, movable). In R_1 let a differential slide wire LE be inserted with the slider at the middle point of LE. Let the bridge now be nearly balanced by moving the point of contact F to an accurately readable position. Now get an exact balance by moving the slider to the right or left. It is evident that if F can be read accurately (set preferably over a scale division), then the ratio of R_1 to R_2 can be read much more accurately than on the ordinary bridge, where F probably falls between two scale divisions—just where is only an estimation.

The motion of the slider may be angular as well as linear. Consider two rheostats or theater dimmers of slightly different resistance, with equal numbers of contacts, and equal angles of rotation from short-circuit to full resistance. Let the resistance between any two adjacent contacts on the same dimmer be the same. Connect the two dimmers in series and mount them on a switchboard so that turning both handwheels in the same direction will increase the resistance in one and decrease it in the other. Turning either handwheel will increase or decrease the resistance normally. Turning each in opposite directions will increase it about twice as fast. Turning both at the same speed in the same direction will change the resistance as slowly as desired.

If the pitches of the threads on the two ends of a turnbuckle nut or stay bolt are in the same direction and slightly different, turning the bolt or nut exerts tremendous longitudinal pressure against any resistance.

Two inductance helixes may be built of the same number of turns, but of slightly different inductance, by varying the size of the wire or the diameter of the helix. By connecting them in series and applying the above principle of differential manipulation, the inductance may be regulated by small degrees.

The above applications of the principle will give the electrical engineer some idea of the adaptability of differential regulation.

Electrification in Russia.

A recent number of *Elektrische Kraftbetriebe und Bahnen* states that the Russian State Railways intend to electrify about 80.6 miles of double track for single-phase operation at a trolley voltage of 12,000 volts to 15,000 volts. The frequency has not yet been chosen. Energy is to be transmitted from a proposed hydroelectric station. The electrified sections, which will be in the surburban districts of St. Petersburg, will consist of a line from that city west to Oranienbaum and of another south to Gatschina and Siverstaja.

Patent Law in Holland.

On June 1 the first patent law ever enacted in Holland went into effect. It is quite similar to the German law but contains several improved provisions.

New Electrical and Mechanical Appliances

A Mechanical Rectifier.

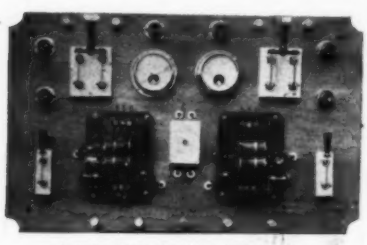
The new Soulier vibrating rectifier is noteworthy in that it is made in sizes up to six kilowatts. It is being placed on the market in France, and has several advantages, one of these lying in the fact that it runs on all the frequencies without any change, and another point is that it is quite sparkless. The construction of the apparatus is quite simple. Two vibrating strips are stretched between two fixed points. Each strip carries at its center a contact which touches a fixed contact during the vibration. An iron core is magnetized by means of a main coil, and also carries two auxiliary coils. The main coil carries direct current or the rectified current

Rectifier for Electrolytic Work.

of the apparatus, and the auxiliary coils carry the alternating current of the mains. Such a combined electromagnet gives to the strips a vibration which is synchronous with the alternating current. Two contact screws serve to vary the distance between the strips and the fixed contacts so as to change the duration of this contact. The system vibrates in synchronism with the usual frequencies, from 25 to 100. To rectify the two waves, the contacts are connected to the secondary of a transformer. Each strip makes its contact in such way that first one wave is collected and then the other. The direct-current device which is to be fed, such as a storage battery, is connected to the middle point and also to the two strips.

In order to obtain a good practical working with vibrating rectifiers, two essential points must be noted, first, a perfect synchronism in spite of variations in frequency, and second, exact correspondance between the strip movement and the curve of the current flowing in the apparatus. In the Soulier method, the first point is realized by using strips whose own vibration is very far from that of the current. For the second point, by modifying the constants of the circuits, it is possible to have the break occur at the exact moment when the current wave is at zero, so that for even as high as 10 to 30 amperes there is seen no spark at the contact when working at 100 to 150 volts. Hence there is no wear of contacts and for this reason a small vibration of the strip is enough, seeing that no arcing is to be feared.

If the frequency of the circuit varies, as is noticed with a small belt-driven alternator, the strips are seen to follow all these changes without any lag and the current is always rectified. This is due to the small inertia



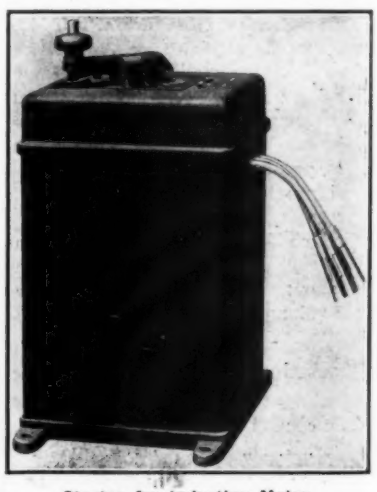
Large Size Soulier Rectifier.

which the strip has, so that it responds at once. The efficiency of the apparatus is high, as the electromagnet does not take over 80 to 100 watts in a rectifier supplying 15 amperes at 100 volts, making 94 per cent. Counting the transformer efficiency at 90 per cent, the net result is about 85 per cent. The only objection which might be made is about the wear of the contacts, but the inventors chaim that during five years' practice work such contacts remain intact.

The device makes scarcely any more noise than a transformer, and this is even an advantage in observing the working by the sound. Electrolysis is done under very good conditions and apparatus has worked for thousands of hours without being watched. Arc lamps run thus on direct current are best for projection work on account of their crater. At present this apparatus is made from 50 watts up to 6 kilowatts. We are indebted for the above information to the Societe des Appareils Economiques d'electricite, of Paris, France.

A Simple Starter for Slip-Ring Motors.

A new form of non-reversing starter for constant-speed, slip-ring motors of 5 to 15 horsepower capacity has recently been placed on the market by the Westinghouse Electric & Manufacturing Company. It is self-contained and of the general appearance shown in the illustration. It is not applicable for speed control. There are three sets of contacts, one for each phase, and three arms, each carrying contacts for one of the phases. The motor is started by moving the handle gradually from the "off" position over the six steps to the "running" position, where it is locked. The handle cannot be left in any intermediate position. In the running position, all resistance is short-circuited.



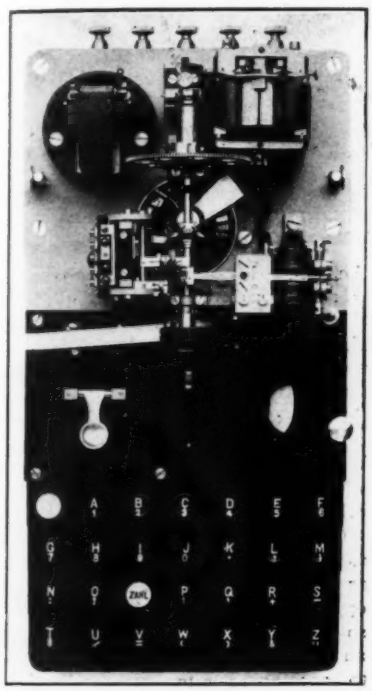
Starter for Induction Motor.

The resistor is composed of resistance wire wound on porcelain tubes and then coated with a heat and moisture-proof varnish, making it practically indestructible. The only wearing parts, the contacts, are easily and cheaply renewed.

The features of this starter are its simple construction, durability, the ease of access to all its parts, and the protection of the resistors and switching device by covers.

The Teleprinter.

Business offices, large hotels and other establishments in Berlin and Hamburg, are now subscribers to the teleprinter exchange. Each office is supplied with one of the new instruments, and anyone can use it to send messages to another subscriber just as he would operate a typewriter. Connection is first made through the central exchange, then all that is needed is to press one of the keys so as to start up. Other keys bear letters and figures, and at the other end a type wheel prints the letters on a paper strip. What is intended is to provide an instrument which any one can use, and without the training which is required by a typewriter. For this reason the keyboard has the letters



Teleprinter Outfit.

placed in regular alphabetical order. Messages are received even if the case is locked up, so that no one but the person having the key is able to read them. When it is desired to send a telegram from a business office to the city telegraph office, this can be done by making direct connection with the telegraph office, as each subscriber can have a teleprinter placed there in the special room devoted to this purpose. Messages are thus sent and received directly and without any loss of time. Up to date there are over 1,200 of the instruments in use in Germany.

The Electric Service Table.

As shown in the illustration, this device is simply an ordinary table of the library type provided with four or more outlets or plug sockets placed on the side, below the surface or top so as to be out of the way, and flush with the table. These outlets provide a ready and convenient means of connecting an electric fan or electric iron without interfering with the free use of a reading lamp or other device.

The important point is that the table represents a complete electrical installation, the meter, main switch, fuses, wiring, etc., being concealed in an iron box placed out of sight in the frame of the table. The connection to the lighting mains is made inconspicuously through a small piece of steel conduit passing from the iron box through the baseboard, and up the outside wall to where the electric service wires connect to the street system; this conduit is well grounded.

One who does not wish to go to the expense of wiring his entire house can secure the comforts and convenience mentioned above, also be in a position to make use of an electric sewing machine, vacuum cleaner or other handy electrical home-comfort apparatus with only a small investment. In this way is also overcome the usual trouble of finding a place to locate the meter. In addition the entire apparatus can easily be disconnected and moved to a new location at practically no expense.

The complaint is often made that where electric service is desired in unwired buildings erected before the advent or general use of electricity the difficulties in the way of installing the wiring are too great to be overcome. In order to fill this want and provide a cheap, easily installed, and at the same time sightly installation, the electric service table has been designed.

The designer and inventor of the apparatus is Wm. E. Clement, commercial agent of the New Orleans Railway & Light Company. Mr. Clement has applied for a patent, and feels convinced that from his observations extending over a period of years there should be a considerable demand for such a convenience.

The table complete is strong and serviceable and is, of course, installed to meet the requirement of city inspection departments and of the National Electrical Code. It has already been highly commended by a number of expert electric men. The Electric Manufacturing Company, of New Orleans, La., is manufacturing the tables for Mr. Clement.

Clement Electric Service Table.

Handsome Mazda Lamp Chart.

The General Electric Company, Schenectady, N. Y., has ready for distribution a large sized wall hanger devoted to General Electric-Edison Mazda lamps. The color scheme is dark blue, light blue and golden yellow. The sun is shown peeping above a section of the sphere of the world looking at a Mazda lamp in full blaze, illuminating its section of the continent a little better than the sun. The legend is "His Only Rival." The chart shows in actual size 18 types of incandescent lamps ranging from the 15 to 20-watt regular to the 500-watt round-bulb lamp. There are also shown the 2.5-watt lamp, the 5-watt sign lamp, the 10-watt sign lamp, the 15 and 25-watt round-bulb lamp, the 60-candlepower street series, the 200-candlepower street series, the 25-watt tubular and the 60-watt round-bulb. The chart is one of the most effectively printed and handsomest issued for a long time.

Storage-Battery Industrial and Baggage Trucks.

A line of efficient storage-battery trucks, for the rapid and economical handling of baggage, freight and miscellaneous manufactured products in railway passenger and freight depots, steamship docks, warehouses, factories and industrial establishments of all kinds, has been placed on the market by the Automatic Transportation Company, 2933 Main Street, Buffalo, N. Y. They are of several types, each designed to be particularly adapted for certain conditions of service.

Nearly all the trucks have a load-capacity of 2,000 pounds. For general freight or baggage service five types of trucks are made 10 feet 3 inches in over-all length and with a platform width of 36 or 41 inches. These trucks have a speed range of 1 to 10 miles per hour in five forward and five reverse speeds. A special industrial truck (type D) is made with a total length of 36 inches; it has three speeds from 1 to 5.5 miles per hour. This truck, as shown in Fig. 1, is particularly serviceable for carrying castings and similar compact, heavy articles through narrow aisles, around sharp turns, up elevators, etc., thus meeting the conditions generally prevaling in factories, mills and many warehouses.

Fig. 1.—Type D Industrial Storage-Battery Truck.

Fig. 2.—Type F General Freight Truck.

In all trucks the power equipment is practically identical. The energy source is a group of National storage batteries contained in a steel box on top of one end of the main platform, thus being readily accessible for inspection and care. The cells have a capacity of 112 ampere-hours. Current passes from the battery through a fuse and circuit-breaker to a drum-type controller and regulating resistances beneath the platform. The steering and control handles are placed on the end of the truck adjoining the battery box; baggage trucks may be operated from each end, however. The operator has a pedal which must be pressed down in order to close the circuit-breaker and simultaneously release a band brake on the jack shaft. Release of the pedal opens the circuit-breaker and sets the brake. A two-horsepower motor with ball-bearing armature drives the jack shaft through a Morse silent chain, sprocket and differential gear. Roller bearings support the jack shaft from which two side-chains run to the drivers.

On the general freight truck, such as the type F shown in Fig. 2, as well as the bagage trucks, the end gate opposite the battery box is hinged, so that it may be made horizontal as an extension of the local platform to accommodate a greater load of bulky articles, or lowered to the floor and used as a skid in loading and unloading heavy articles on and from the truck. The under body of the trucks consists of a frame with two steel channels which is supported on four spiral springs transferring the load directly to the axles and acting as effective shock absorbers. Rigid steel axles are provided that run in roller bearings. The wheels are 16 inches in diameter and are equipped with solid rubber or fabric tires.

These trucks have been found a very economical means for expediting the haulage of raw and finished products through the different departments of large industrial plants. They have also proven very successful in the handling of freight at docks, freight depots and warehouses; it has been found that they cover a certain dis-

tance in about one-fourth the time required by hand trucking, besides carrying six times as great a load. Their compactness and rapidity of action greatly increases the capacity of a freight house or dock and immediately relieves the congestion so commonly prevalent. They produce a marked reduction in the number of men required to carry on the work. The trucks are so easy to control and are made so rugged and foolproof that skilled operators are not needed.

The Automatic Transportation Company also builds a storage-battery "engine" or locomotive that can pull or push several other cars on an industrial railway track besides carrying a considerable load itself.

Combined Voltmeter and Wattmeter.

The accompanying illustrations show new combined voltmeter and wattmeter which is brought out by Carpentier, of Paris. It is designed for making accurate readings, and consists essentially of a movable coil taking the voltage, and a fixed field coil which produces the deflection. The field coil is removable from the box, and thus the instrument can be used with a number of such coils of different sizes which are interchangeable like the shunts of an ammeter, so that this gives a very wide range to the instrument. The box contains the movable coil, provided with an air dash pot and the usual scale and needle. Extra resistances (Fig. 2) complete the fine-wire circuit. At the top of the box is inserted the field coil, and this is done very conveniently by sliding the block in the opening in the main box just as a drawer is slid in. It is then held in place by two spring clamps. All the separate coils or blocks are of standard size and have a tight fit, so that there is no variation. Their winding is different according to the current to be carried, the number of ampere-turns being kept constant at about 600. In this way it is possible with some precautions to have the same graduation for all the different coils, so that to make measurements all that is needed is to multiply the scale reading by the figure corresponding to the coil. For the 30-ampere coil, for instance, the scale reading is multiplied by 30 so as to give the number of watts. Field coils are used for 1 to 300 amperes. The fine-wire movable coil takes a current of 0.02 ampere for a direct scale reading and 0.04 for double reading. By using a fine-wire field coil which is inserted like the others, we have a standard voltmeter for direct or alternating current, now reading on the volt scale. When so used, the instrument takes about 50 milliamperes.

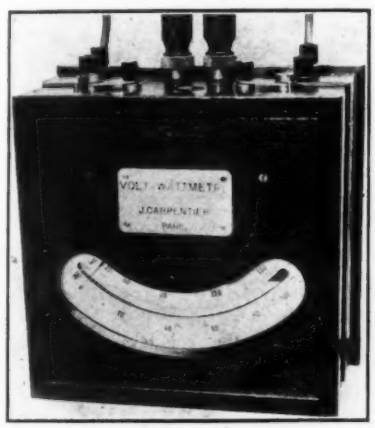


Fig. 1.—Combination Carpentier Instrument.

Fig. 2.—Complete Instrument Set with Extra Resistances and Leads.

Prevention of Hail by Use of Lightning Rods.

A new type of hail destroyer is being tested in France on a large scale, according to the report of an American consular agent. The device is essentially a very large lightning rod of pure copper grounded by means of a copper conductor. According to the theory of the inventors, these instruments, by their effect upon charges of atmospheric electricity, are capable of preventing the formation and fall of hail stones.

The French Government, through a special commission of senators and deputies, is studying the process and has encouraged experiments to be undertaken. A chain of hail destroyers of the new type will be established in important vine-growing districts which heretofore have suffered heavily from hail storms, notably in the Departments of the Gironde, the Beaujolais, the Loire Inferieure, and the Charente. In Paris an "electric Niagara" will be installed in the Eiffel tower and supplementary posts will very likely be established on the dome of the Pantheon and on an edifice in the northern part of the city.

The great damage wrought by hail and lightning in France each year, with losses estimated at approximately $20,000,000 to $30,000,000, will cause the experiments now under way to be followed with close attention. Many of the posts have been completed and the results obtained will be carefully noted and studied. In order to determine the efficacy of the new device with any degree of accuracy it is realized that systematic tests during a period of years will be necessary, and to supervise the work a committee has been formed, some of whose members are representatives of the French Government.

The belief that electricity is largely responsible for the formation and precipitation to the earth of hailstones has long been held by some French savants, and efforts to utilize lightning rods for purposes of protection have been previously made, but it is now believed that the instruments heretofore employed were of an imperfect type. It is claimed that the new "paragrèle" with its multiple points and perfected apparatus is capable of drawing down such great quantities of electricity from the clouds as to render them innocuous as to hail and lightning Although this may not be a generally

accepted theory as to hail, it can at least be said that experiments along the lines indicated will be of interest for scientific purposes.

The new device is comparatively inexpensive to construct. In a general way it may be described as a rod of copper at least 130 feet high terminating in a crown, or aigrette, of copper blades. The base terminates in a large pool of water, preferably flowing water. Church steeples, factory chimneys, or structures specially built may be utilized for obtaining sufficient elevation, but care is necessary in fulfilling all the requirements as to conductivity. According to the plan now followed the rods are erected at intervals of about six miles along a line transverse to the usual path of hailstorms. It is stated that encouraging results have been obtained thus far wherever the instruments have been placed.

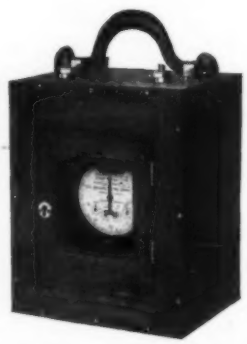
Shop Testing with Portable Shunted-Type Watt-Hour Meters.

In every electrically driven factory there frequently arises a demand for a portable watt-hour meter which can be quickly connected in circuit with the motors or lamps. The kilowatt-hour input to an electrically driven machine or group of machines is a very accurate index as to the mechanical output, for it will readily be seen that if a motor is not consuming energy the driven machine cannot be turning out work. By connecting a portable integrating meter in circuit and operating the driven machine at its most economical and efficient point, a record will be secured of the kilowatt-hours input necessary to perform a certain amount of work. By securing this data on all machines, a standard can be established which will be of value in making plans for increased production.

The use of a portable tester is also advisable in reducing motor burnouts as it will often be found that the motors are carrying heavy overloads which will eventually result in heavy repair bills unless the conditions are remedied. The reverse condition applies when motors are operating below capacity, as their efficiency is less, the investment abnormally high and the machine's full productive possibilities are not being realized. Portable testers will also serve as a check on the unauthorized use of current, such as night burning of lamps, running of elevators, etc. By connecting a tester in different circuits the management will soon ascertain the actual conditions and can frequently effect a large saving in the power or lighting bills. There are many other instances where a portable tester will be found of much value, such as in their use by central-station power solicitors in estimating costs, by consulting engineers in securing data, etc.

To meet the severe conditions of portable service, the Sangamo Electric Company, of Springfield, Ill., has developed the new line of portable meters illustrated herewith. The measuring elements are of the mercury flotation type so successfully used in the well known Sangamo electric-vehicle meters, thus securing immunity against damage by shocks or jars. The meters are all of the shunted type, thus by the use of a few extra shunts a very large range of measurements can be made with a single meter.

Multiple potential circuits are furnished so that circuits of 110, 220 or 550 volts can be tested without change of meters. An important feature of this meter is in the provision of a special reset dial operated with a key. After each test or run, the large dial is read and the hand set back to zero without in any way affecting the reading on the small dials, which, therefore, give a record of the total energy consumed. The use of this reset fast-moving register is of the highest importance in securing records of energy consumed in comparatively short intervals of time. The entire mechanism is mounted in a substantial hard-wood polished carrying case, provided with handle, necessary binding-posts, and lock.



Sangamo Portable Watt-Hour Meter.

More Telephones for the Pittsburgh & Lake Erie Railroad.

The Pittsburgh & Lake Erie Railroad some time ago installed a telephone train-dispatchng system on its lines, and is now preparing to supplement this with a selectively operated "message wire" to be used for transacting only commercial affairs. No train-movement orders will be handled over this line.

The Western Electric Company, which furnished the apparatus used on the train-dispatching circuits, will also supply that to be used on the message wire, which will extend from McKee's Rocks to Woodlawn, Pa., a distance of approximately 17 miles. A full-metallic line built of No. 12 B. & S. copper wire will be used, along which 15 way stations will be equipped.

This telephone line will terminate in the road's private-branch exchange and the calls will be handled just the same as on a party line, the switchboard operator calling each station without signalling the others.

Columbia Sales Conference.

The annual conference of the salesmen of the Columbia Incandescent Lamp Works of General Electric Company was held throughtout the week from August 11 to 17 at the Macatawa Hotel, Macatawa Park, Mich. Morning and afternoon sessions were held at which A. C. Garrison presided and Mr. Oldham acted as secretary. Addresses were made by A. C. Garrison, P. F. Bauder, N. H. Boynton, C. W. Bender, G. C. Webster, W. Harrison, E. J. Edwards, L. H. Britton, J. O. Presbrey, W. G. McKitterick, D. W. Daily and others. Active discussion of the pending advertising and sales compaign for Mazda lamps, some new sales methods, numerous technical and commercial problems and the business situation was indulged in. Along with the strenuous business program there were interspersed many pleasing entertainment features.

Buckeye Conference.

The annual conference of the sales representatives of the Buckeye Electric Works was held at Geauga Lake, O., August 19 to 24. Forty-two men from all parts of the country attended the conference and the exclusive use of the Hotel Grace was acquired for their accommodation. Addresses were made by J. Robert Crouse, L. P. Sawyer, W. G. McKitterick, J. M. Smith and others. Business sessions were held in the morning, while the afternoons were devoted to athletic contests and other recreation. The Buckeye baseball team was defeated by the Geauga Lake team by a score of 9 to 6.

R. H. Craft was the composer of a very clever song dedicated to Mr. Sawyer and entitled "To Our Pal."

The production of copper in Montana decreased from 284,808,553 pounds in 1910 to 272,847,705 pounds in 1911, a loss of 11,960,848 pounds. The Summit Valley or Butte district contributed all but 589,253 pounds of the total.

The exports of coal from the United States during 1911, according to the United States Geological Survey, were 17,432,753 long tons, valued at $52,593,274, compared with 13,805,866 long tons, valued at $51,470,792, in 1910.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

SANDERSON, TEX.—Ed. McGinley is arranging to install an electric light plant here. D.

WEEDSPORT, N. Y.—This place is considering the question of a municipal electric lighting plant.

CHISHOLM, MINN.—F. C. Lang has secured a franchise for an electric lighting plant at this place.

LEOMINSTER, MASS.—A municipal lighting plant will be installed at the High School here.

WHEELING, W. VA.—The Mayor is in charge of a movement to appropriate $75,000 to install an electric plant.

SARDIS, GA.—It is reported that the Sardis Water Works, of which J. A. Davis is manager, will erect a lighting plant.

MARSHALL, MINN.—The business men of this town have raised $2,000 for the improvement of the lighting system.

WATKINSVILLE, GA.—This town has under consideration a bond issue for the installation of an electric light system.

CAMP HILL, PA.—The Camp Hill Council has appropriated $300 to secure expert opinion on a municipal light and water plant.

MANCHESTER, IOWA.—This city has concluded to extend the electrolier lighting system over three of its principal streets.

WELLAND, ONT.—This city has passed a by-law providing for an expenditure of $45,000 for a municipal electric plant.

REGINA, SASK.—A. W. Pool, city clerk, will receive bids until September 14 for furnishing a steam turbine unit, switchboard, etc.

NEWARK, N. J.—The Public Service Commission contemplates installing 50 2,000-candlepower arc lamps and 132 incandescent lamps.

COLLINSVILLE, ALA.—Isby C. Hall is planning to rebuild the electric lighting plant here, which was recently destroyed by fire.

PAULDING, O.—It is said that a $30,000 bond issue has been voted by the citizens of this place for improvements to the electric light and water works plant.

PETALUMA, CAL.—The Great Western Power Company has been granted a certificate of public convenience and necessity to operate in Petaluma and Sebastopol.

RICHMOND, VA.—It is reported that William J. Payne of this place is planning to construct a hydroelectric plant on the North River near Goshen Pass.

ASBURY PARK, N. J.—The City Council has passed an ordinance providing for a condenser, or similar equipment, on the steam exhaust at the Beach Casino. A.

CAMBRIDGE, MASS.—The Cambridge Electric Company will remove its overhead wires on Massachusetts Avenue and install them in underground conduit.

TRINITY, TEX.—Trinity Power Company has been incorporated with a capital stock of $4,000 by H. H. Thompson, W. A. Bell and Jacob Embry, all of Trinity.

TOPEKA, KANS.—It is reported that the Board of City Commissioners is considering installing a "White Way" from First Street to Gordon Street on Kansas Avenue.

STANDFORD, KY.—Water, Light & Ice Company will install additional machinery and provide current for day consumption. George P. Penny is manager of the Company. G.

HOUGHTON, MICH. — Mayor Dodge of this city is in charge of a movement to install a municipal power plant, which, it is expected, would mean an expenditure of $40,000.

PENNSGROVE, N. J.—Pennsgrove, Electric Light, Heat & Power Company has been incorporated with a capital stock of $50,000 by Gwyllym R. Holmes, of Baltimore, Md.

NOCONA, TEX.—The Nocona Ice & Light Company has been organized here with a capital stock of $15,000. The incorporators are W. D. Carmichael, C. P. Dodson and H. T. Weathers. D.

CANTON, ILL.—The Street Lighting Committee of the City Council has been instructed to prepare a report as to the feasibility of establishing a municipal electric light plant in this city. Z.

MOBILE, ALA.—The Mobile Electric Company has announced its intention to add improvements to its power plant, whereby its present power capacity will be almost doubled.

LEBANON, IND.—It is reported that the Middle West Utility Company of Chicago has purchased the property and plant of the Citizen Electric plant and will add many new improvements.

MATTOON, ILL.—The site for an addition to the power house has been purchased by the Central Illinois Public Service Company and right of way is being secured for a transmission line to Neoga. Z.

HEBRONVILLE, MASS.—Superintendent Tregoning of the Attleboro Steam & Electric Company has in charge the matter of improving the present system of street lighting in Hebronville.

LAKE GEORGE, N. Y. — Lake George Highway Lighting Company has been incorporated with a capital stock of $5,000 by Charles J. Peabody, John Peterson and Elias Taylor, all of Lake George.

AVILLA, IND.—Plans submitted by the Olds Electric Company of Fort Wayne have been accepted by the Citizens of Avilla, and an electric light plant will be installed in the village. The current is to be transmitted. S.

PORTLAND, CAL.—Installation of cluster lights is being considered by the property owners between the river and the head of Morrison Street. Work will be in charge of R. H. Young, C. H. Korroll and Gwilyn Jones.

BEAUMONT, TEX.—The Beaumont Electric Light & Power Company is preparing for a lighting system on Pearl Street which will necessitate placing the wires on the steel poles, which will also carry the lights.

BUTLER, PA.—A mortgage for $250,000 from the Butler County Light Company to the Pittsburgh Trust Company has been filed, the money to be used to finance the construction of the plant of the Butler County Light & Heat Company.

SACRAMENTO, CAL.—The Great Western Power Company will in a few weeks commence the work of extending its power transmission line along the route of the Central California Traction Company, as far as the Consumnes District.

MEMPHIS, TENN.—Electrical equipment will be needed shortly for the William R. Moore College of Technology, which is now preparing to secure a site and begin operations. The college has a $500,000 endowment. T. O. Vinson is one of the trustees. G.

LOS ANGELES, CAL.—Articles of incorporation have been filed for the Aerial Illuminating Company of California, with a capitalization of $2,000,000. The directors are Jane R. Austin, Archibald J. Austin. Kay Munnich, T. J. Marcus and Elsie Gardner.

PARIS, ILL.—A committee composed of W. H. Hodge, E. E. Gregg, H. L. Jones, Edward Levings and George V. Dole has been appointed by the Chamber of Commerce at this place to investigate the matter of installing pedestial street lamps.

PASSAIC, N. J.—The Board of City Commissioners is considering the establishment of an ordinance requiring the Public Service Company to place its overhead lines for traction and lighting service in underground conduits in important sections of the city. A.

MONTCLAIR, N. J.—The town council has awarded a five-year electric-lighting contract to the Public Service Electric Company and is also arranging to establish additional lights on Bloomfield Avenue, in the form of arc lamps suspended from ornamental iron poles.

IRVINE, KY.—Edwin C. Stevens, Louisville, Ky., is considering the installation of a lighting plant of moderate capacity here, as Irvine will be the location of large shops of the Louisville & Nashville Railway Company, which is building an extension to that point. G.

TIFTON, GA.—At a mass meeting

of business and professional men the legality of the franchise which the City Council recently granted to the Tifton Ice & Power Company was discussed with a view to revoking same and establishing a municipal electric lighting plant.

ALBANY, N. Y.—The Santa Clara Light & Power Company, with principal office in Manhattan Borough, has been incorporated with a capital stock of $800,000. The directors of the company are S. J. Bischoff, Peter J. Brancato and David J. Broderick, all of Brooklyn.

ABINGDON, ILL.—The proposition to issue $7,000 worth of bonds for the establishing of a municipal electric light plant has been defeated and a contract will be entered into with the Abingdon Light & Power Company. A new system of street lighting is contemplated. Z.

PHILLIPSBURG, N. J.—The Board of Trade is considering the establishment of an electric-lighting plant to compete with the local lighting company. Members of the Board desire that the plant shall be owned and controlled by consumers only, and local capitalists will be asked to contribute funds. A.

MAYWOOD, ILL.—This town is considering the installation of an electrolytic sewage plant and has sent Edward Bartow, professor of sanitary chemistry in the University of Illinois, and director of the Illinois Water Survey, to Oklahoma City to study the operation of the plant which has been installed there.

HOUSTON, TEX.—As a part of the improvements which the Southern Pacific Railroad Company will make to its Atlantic system in Texas, there will be erected here a large central electric power station. This plant will provide electric power for operating the machinery of the shops, boiler works and transfer table. D.

BINGHAMPTON, N. Y.—William Nelson, secretary of the Chamber of Commerce, has submitted a plan to the Mayor for the building of a dam in Susquehanna, which would furnish enough volume to operate a municipal lighting plant. It has been reported that the City Administration is looking for a good site for a municipal lighting plant.

PRESTON, MINN.—The Root River Power & Light Company has filed articles of incorporation with a capital stock of $100,000 for the purpose of developing water power on the Root River for use in this city. The incorporators are W. H. Williams, S. A. Langum, Ole T. Brokken, H. Somer, Jr., A. H. Hanning and others.

SUMMERFIELD, KANS.—The City Council has granted a 20-year franchise to Harry D. Hockman, of Beattie, to install and operate at this place an electric lighting system, the power to be supplied from the power house at Beattie, which is 14 miles distant. Work is to begin on the erection of the power line from Beattie to Summerfield in the immediate future.

SAUGATUCK, MICH.—The Lake Shore Electric Company opened up a month ago the first central station this town ever boasted of. The lines are being rapidly extended to the adjoining town of Douglas and service in the latter will begin soon. About 140 series tungsten street lamps will light up both the towns, half of these being already in use here.

NEW YORK, N. Y.—Carroll Electric Light & Power Company has been incorporated with a capital stock of $5,000 for the purpose of manufacturing electricity for light and power purposes in several towns in Chautauqua County. The incorporators are Hugh A. Sigins and Sam Q. Smith, Warren, Pa., and Frank H. Mott, Jamestown, N. Y.

NEW ORLEANS, LA.—Sealed proposals will be received by the Secretary, Room 508 City Hall Annex, until September 19 for furnishing and erecting complete the piping and auxiliaries for Power House No. 2. Specifications, etc., may be obtained from the office of the Board upon deposit of $10. Certified check for $100 must accompany each bid and a surety bond in the sum of 25 per cent of gross amount of contract will be required of the successful bidder.

PALESTINE, TEX.—The Texas Utilities Corporation of Dallas which was recently organized to take over and operate a number of electric light and power plants in different cities of North Texas has just closed a deal for the purchase of the local plant of the Palestine Electric Light & Ice Company. It is reported that the new owners will enlarge the plant and probably construct an interurban electric railway between Dallas and Palestine, a distance of about 100 miles. D.

LOCKPORT, N. Y.—The Aldermanic Committee on Lamps and Gas has voted in favor of the inverted magnetite arc. Eighteen of these will be installed on Main Street by the Power Company without expense to the city. The Power Company proposes to put in 44 of the new type of lamps but the city is not prepared to pay for the power the extra 26 would use and President Moon, of the Chamber of Commerce, is securing contributions from the business men to make up a fund to pay for the additional 26 lamps, so that the new system of lighting may be completed all at once.

CHATHAM, N. J.—The Borough Council has adopted an ordinance providing for a bond election to vote $35,000 for the extension of the municipal lighting system. The Board of Water Commissioners has been authorized to call for bids for the following equipment: 75-kilowatt 2,300-volt three-phase generator with foundations, two 250-horsepower, B. & W. boilers, one 35-horsepower, 2,300-volt, three-phase motor, one steam-driven engine, one electrically-driven pump, one 250-horsepower condenser, one switchboard complete, piping, wiring, feeders, etc. A.

MONTICELLO, IND.—A new electric light merger, with $1,075,000 initial capital stock, has been formed to be known as the Northern Indiana Utilities Company. The plan of this merger is to take over and operate all the plants in the small towns from Monticello to the Illinois State line. The new company has already secured the old properties in Monticello, Walcott, Earl Park, Fowler, Kentland and other towns containing electric light plants. At Monticello where there is a hydroelectric plant, it is expected to transmit current by high-tension lines to the other towns. The officers of the new company are Samuel Insull, president; C. A. and E. T. Munroe, vice-presidents and A. S. Scott, secretary-treasurer. S.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

SPOKANE, WASH.—The Interstate Telephone Company will install a new exchange in St. Maries, Idaho.

GLOVERSVILLE, N. Y.—The Glen Telephone Company expects to be granted a franchise to lay conduits through the streets of this city.

BAY CITY, MICH.—It is reported that the Valley Telephone Company will spend $200,000 in rebuilding its plant at this place.

RIALTO, CAL.—Bids will be received up to October 1 for the right to transmit electricity in this city for telephone and telegraph purposes.

WHITESBURG, KY.—Whitesburg Telephone Company is planning to extend its local and long-distance telephone lines to McRoberts.

ROCHESTER, MINN.—A franchise has been granted to the Rochester Telephone Company for 15 years and it is understood that the company will make many improvements to the system.

NEW WASHINGTON, O.—The Cranberry Mutual Telephone Company has been incorporated by J. E. Wels and others. The company is not formed for profit.

RIALTO, CAL.—The Pacific Telephone & Telegraph Company has applied for a 50-year franchise to operate and maintain a telephone system in Rialto.

KEWANEE, ILL.—Stockholders of the Henry County Telephone Company will meet September 16 at Atkinson to decide upon increasing the capital stock to $30,000.

FISK, MO.—The Farmers' Telephone Company has been incorporated with a capital stock of $2,500. The incorporators are W. J. Harrington, R. P. Neel, John F. Jordan and others. Z.

NEW MARKET, TENN.—L. P. Esslinger is the president of a new telephone company which has been organized here for the purpose of installing and operating a telephone exchange at this place.

OKLAHOMA CITY, OKLA.—A charter has been granted to the Davis Rural Telephone Company, which has a capital stock of $1,000. The incorporators are Charles Hutchins, J. F. Ellis and W. M. Baughman.

THIEF RIVER FALLS, MINN.—The Tri-State Telephone Company has made a proposition to the Commercial Club to install a new and modern central energy system, put in cables and place poles in the alleys. C.

WYMORE, NEB.—The Wymore Independent Telephone Company has been incorporated with a capital stock of $25,000. The incorporators are J. Neumann, M. J. Moran, C. C. Gafford, E. B. Crawford and I. T. Cutshall.

CLEVELAND, O.—The Cleveland Telephone Company has been granted permission to issue $900,000 worth of stock with the understanding that the money so raised will be used exclusively for extensions and improvements of the service.

BEAUMONT, TEX.—It has been announced that the Southwestern Telegraph & Telephone Company will start at once on reconstruction work in this city. It is estimated that the total cost of the improvements to be made here will be about $7,000.

ELECTRIC RAILWAYS.

(Special Correspondence.)

SUPERIOR, WIS.—The Superior Steel Plant Traction Company expects to prepare the roadbed this fall for the proposed car line.

LUVERNE, MINN.—A franchise for an electric railway was granted to the Sioux Falls & Southern Minnesota Traction Company. C.

FARGO, N. D.—The Union Light, Heat & Power Company will start work at once on the construction of the car-line to Dilworth, Minn. C.

ALTOONA, PA.—The Altoona & Logan Valley Electric Railway Company is making arrangements to improve the tracks in certain streets of the city.

HERINGTON, KANS.—M. H. Mott and J. H. Kohler are interested in a project which is on foot to build an electric car line to Junction City and Fort Riley.

SAN FRANCISCO, CAL.—The State Board of Harbor Commissioners is contemplating the construction of an electric car line along the waterfront of San Francisco.

RIVERSIDE, CAL.—This city has raised nearly $3,000 toward the Crescent City Electric Railway extension to Rialto and citizens here are very enthusiastic over the prospects.

CRESWELL, ORE.—The Creswell Development League is interested in securing any electric interurban line that may be built this way, and is at present discussing a line to Eugene.

GLENDALE, CAL.—The Glendale & Verdugo Park Railroad Company will begin active operations immediately, all the stock having been subscribed and the necessary money been paid in.

PEORIA, ILL.—The Chicago, Peoria & Quincy Traction Company has been incorporated with a capital stock of $200,000 for the purpose of building a railway from Quincy to Peoria.

BANDERA, TEX.—The citizens of this place are interesting themselves in the building of an electric traction line from San Antonio via Mico to Brandera, a distance of about 40 miles.

SAN JOSE, CAL.—Bids will be received up to September 7 for the sale of the electric railroad franchise in Santa Clara County applied for by the San Jose & Almaden Railroad Company.

MOBILE, ALA.—The Mobile Interurban Railway Company has been incorporated with a capital stock of $5,000 for the purpose of operating an electric line. The incorporators include C. V. Schoub.

FATE, TEX.—C. E. Obenchain, Jr., chief engineer of the Eastern Texas Traction Company, has completed a survey for a new route of the interurban which will be built between Fate and Rockwall.

COLUMBUS, O.—The County Commissioners have granted a franchise to the Columbus Rail-Light Company to extend a double track in Cleveland Avenue to the North corporations of Linden Heights.

WARREN, PA.—It is reported that the Warren Street Railway Company is planning to extend its line to the West End early in the spring, and it is thought that this line will eventually be extended to Youngsville.

LOS ANGELES, CAL.—The tramway system of San Luis Potosi has been sold to an English Company, consisting of Messrs. Hooghwinkel, Brown and partners, of London. The new owners will electrify the line.

SANFORD, ME.—George O. Hawes, of this place, has finished a survey for Portland parties for an electric railroad to Alfred, a distance of about five miles. It is expected that a company will be organized to finance the construction.

ROCHESTER, N. Y.—It has been announced that the Erie Railroad would electrify its Conesus Lake branch in the immediate future. The total electrification including new construction will be about eight miles, extending from Avon to Lakeville.

IOWA CITY, IOWA.—Articles of incorporation have been filed by the Davenport, Iowa City & Western Railroad with a capital stock of $2,500,000. The purpose of the company is to build an interurban electric railway from Iowa City to Davenport.

COLUMBUS, O.—The Dayton & Troy Electric Railway Company has asked permission to increase its capital stock from $1,000,000 to $1,300,000, part of the money to be used on improvements. The company operates a traction line between Dayton and Pipua.

CHARLESTON, S. C.—The City Council has granted a 35-year franchise to the Charleston & Summerville Interurban Railway Company to operate in this city a railroad on which may be used storage battery, electric, cable or compressed air passenger and freight cars.

OGDEN, UTAH.—It has been reported that Simon Bamberger, president of the Salt Lake & Ogden Railway Company, is negotiating for an interstate electric line to run from Salt Lake, Ogden and other Utah points to Boise, Idaho. The route has not yet been decided upon.

CINCINNATI, O.—It is reported that Street Car Expert Harris is planning for a new crosstown car line, which will start from Madison Road, near Erie Avenue, and follow Langdon Avenue and Dana Avenue to Reading Road and thence by Mitchell Avenue to the Millcreek Valley.

FRESNO, CAL.—It is reported that the Porterville Northeastern Railroad Company will electrify its road within the next year or so, and that the proposed railroad to the Woodville District will also be made an electric line. This would necessitate the power plants on the upper Tule River being enlarged to meet the increasing demand.

POULTNEY, VT.—Announcement has been made by W. S. Barstow, president of W. S. Barstow & Company, of New York, that $500,000 will be expended in the next few months on extending the street railway and power transmission lines through the quarrying district and in further developing the public utilities' properties of this vicinity.

CENTRALIA, ILL.—E. E. Fyke, chairman of the Railroad and Transportation Committee of the Commercial Club has had placed before him by the promoters of the street railway extension a proposition to take 80 bonds of $100 each and dispose of them. The matter is now under consideration. It is expected that the total cost of construction will be in the neighborhood of $30,000.

MEMPHIS, TENN.—It is rumored that the Lakeview Traction Company, which it is said has unlimited capital at the command of its bondholders, will buy in the road at the receivers' sale on September 12, extend the line beyond Lakeview and build from Memphis to Collierville. This will give the city of Memphis an interurban system fully equipped that will represent a value of several million dollars within a year or two.

FORT WORTH, TEX.—The project of constructing an interurban electric railway between Fort Worth and Mineral Wells has been revived by William Brown and associates and steps are being taken to organize a company to carry out the plans of the promotors. The proposition is receiving the support of business men and citizens generally of Fort Worth and other towns directly interested. The proposed line will be about 60 miles long. D.

ARDMORE, OKLA.—The Ardmore Western Interurban Railway Company has been granted a charter by the Secretary of State. The capital stock is $300,000 and the incorporators are J. S. Owens, D. E. Allen, T. C. Bridgeman, W. R. Burnett, C. B. Kendrick and R. A. White, of Ardmore, and J. L. Jordan, of Marietta. The company plans to build about 100 miles of railway from Ardmore northwest through Carter, Jefferson and Love Counties, and a branch line from Springer north into Murray County.

PLYMOUTH, MASS.—At the annual meeting of the directors of the Plymouth & Sandwich Railway Company it was decided to extend the line to Sagamore and thence to Buzzards Bay Station, where it will connect with the New Bedford, Middleboro & Onset Railway. When the Cape Cod Canal is completed the traveling public will have the opportunity of connecting with New York and Boston steamers at Sagamore and Buzzards Bay. Surveys and plans for this extension have been made and it is expected to have the line built as far as Sagamore next June and to Buzzards Bay a few months later.

OKLAHOMA CITY, OKLA.—Announcement is made from Ponca City that Arkansas City, Kans., capitalists have financed the construction of an interurban line from Arkansas City south into Kay county, Okla., which will connect the towns of Chilocco, Kildare, Newkirk, Blackwell, Ponca City and Tonkawa. Surveyors will start out at once to map out the proposed route, which will be something more than 50 miles in length. The backers of the line are C. T. and Lafe Brown, eastern capitalists, and C. T. Atkinson, A. H. Denton and E. Kirkpatrick of Arkansas City. An extension to Winfield of the line now working south from Wichita is also projected. P.

SAN FRANCISCO, CAL.—The Sacramento Valley Electric Company has obtained authority to issue over $3,000,000 worth of stock, the plan being to build a line down the Sacramento Valley. The electric line is to begin at Red Bluff and run through Tehama, Glenn, Colusa, and Yolo Counties to Woodland, and thence to Dixon, where it is proposed to connect with the Antioch & Eastern Railway. It is also proposed to run a branch line from Colusa to Williams. It is estimated that the length of the line will be 160 miles and that the total cost of construction will be over $4,000,000. It is proposed by the company to secure rights of way by paying for it with common stock.

FOREIGN TRADE OPPORTUNITIES.

(Parties interested in the following items should address the Bureau of Manufacturers, Washington, D. C., and refer to the file number noted.)

NO. 9409. EQUIPMENT FOR ELECTRIC LINE.—An American consul in South America reports that a line six miles in length, three-foot gauge, has been acquired by a corporation which expects to improve the road. The cars will be run by electric power from a plant now in operation. About four cars will be needed for the new equipment. The engineer of the company would be pleased to receive new equipment. The engineer of the company would be pleased to receive estimates for the equipment, as well as for generating machinery.

NO. 9412. ELECTRIC HAIR DRIERS.—An American consul in Asia informs the Bureau of Manufactures that he has received an inquiry for electric hair driers. American manufacturers in this line should send catalogues and price lists to the address given in the report.

FINANCIAL NOTES.

S. R. Caldwell, West Chester, Pa., has been appointed temporary receiver for the United Telephone and Telegraph Company, of Philadelphia, by Judge C. V. Henry, in Common Pleas Court. The United is a subsidiary of the American Union Telephone Company, which is in the hands of receivers named by the United States Court. Mr. Caldwell is secretary and treasurer of the United, which has a number of lines in Eastern Pennsylvania.

Governor Tener has approved the merger of six electric companies in the northern and central portions of the State into the Central Pennsylvania Electric Company, of Lock Haven, with a capital stock of $30,000. The companies merged are the West Branch Light, Heat & Power Williamsport; Susquehanna Light, Heat & Power Company, Jersey Shore; Logan Electric Company, Bellefonte; Avis Light, Heat & Power Company, Avis; Patterson-Scootac & Clinton Light, Heat & Power Companies, of Lock Haven.

During the fiscal year just ended, the first full year of its operation since its absorption of the Norfolk and Portsmouth Traction Company, the Virginia Railway and Power Company's gross earnings were $4,558,193.92, an increase of $221,988 over the preceding year; its operating expenses $2,422,903.73, an increase of $81,227.54; its net earnings $2,135,290.19, an increase of $140,760.46; its other income $69,158.67, an increase of $22,862.66; its gross income $2,204,448.86, an increase of $163,623.12; taxes, licenses, interest sinking funds, rentals, $1,423,201.76 an increase of $26,257.83, and surplus $781,247.10 an increase of $137,364.29. The total railway mileage of the company is about 257 miles. It owns and controls the commercial electric lighting and power business of Richmond, Petersburg, Norfolk, Portsmouth and Suffolk, the interurban electric railway, connecting Richmond and Petersburg, the electric railways of Norfolk, Portsmouth and Suffolk, and the gas company and ferries around Norfolk.

Dividends.

Chicago Elevated Railways Company, quarterly dividend of 1.5 per cent on the preferred stock, payable September 2 to stock of record August 21.

Cities Service Company, monthly dividend of .5 per cent on the preferred stock, payable September 1 to stock of record August 20; monthly dividend of .5 per cent on the preferred stock, payable October 1 to stock of record September 15; monthly dividend of 1.33 per cent on the common stock, payable September 1 to stock of record August 20; monthly dividend of 1.33 per cent on the common stock, payable October 1 to stock of record September 15.

Philadelphia Electric Company, quarterly dividend of 1.5 per cent, payable September 14 to stock of record August 21.

St. Joseph Railway, Light, Heat & Power Company, quarterly dividend of .5 per cent on the common stock, payable August 31 to stock of record August 15.

General Electric Company, stock dividend of 30 per cent to stock of record December 31.

Consolidated Gas Electric Light & Power Company, semi-annual dividend of 3 per cent on the preferred shares and the usual quarterly dividend of 1.25 per cent on the common, payable October 1 to stock of record September 20.

New England Telephone & Telegraph Company regular quarterly dividend of 1.75 per cent payable September 30 to stock of record September 10.

American Railways Company; regular quarterly dividend of 1½ per cent payable September 16. Books close August 29 and reopen September 20.

Reports of Earnings.

BANGOR RAILWAY & ELECTRIC.

The Bangor (Me.) Railway & Electric Co. reports for June and the 12 months ended June 30:

	1912	1911
June gross	$ 61,590	$ 49,580
June net	33,257	24,243
June surplus	16,699	11,771
12 months' gross	655,622	574,980
12 months' net	360,451	304,680
12 months' surplus	178,985	158,163

VIRGINIA RAILWAY & POWER.

	1912	1911
July gross	$408,138	$404,526
July net	196,423	194,792
Other income	7,589	4,103
Total income	204,013	198,896
Surplus after charges	81,025	80,105

CITIES SERVICE COMPANY.

The Cities Service Company reports earnings for the twelve months ended July 31, 1912, as follows:

Gross earnings	$1,116,291
Net earnings	1,040,137
Preferred dividend	574,036
Common dividends	189,240
Surplus	276,860

Total accumulated surplus to July 31, 1912, was $472,027. Earnings for the twelve months ended July 31, 1912, were at the rate of 8.89% on the outstanding common stock.

PACIFIC POWER & LIGHT.

The Pacific Power & Light Company, Portland, Ore., controlled by the American Power & Light Company, reports earnings for July, 1912 and the 12 months ended July 31, 1912 as follows:

	1912	1911
July gross	$ 103,201	$ 92,336
July net	52,681	34,673
July net income	28,738	3,047
12 months' gross	1,218,018	1,164,906
12 months' net	592,113	548,005
12 months' net income	266,673	268,368
12 months' preferred dividends	148,125	65,625
12 months' surplus	118,548	202,743

KINGS COUNTY ELECTRIC LIGHT & POWER.

Kings County Electric Light & Power Company, Brooklyn, N. Y., reports earnings for July and seven months' gross as follows:

	1912	1911
July gross	$ 391,220	$ 358,663
Net after taxes	123,875	123,550
Other income	821	5,442
Total income	124,696	128,992
Surplus after charges	54,149	58,796
Seven months' gross	2,990,076	2,665,992
Net after taxes	1,091,978	990,275
Other income	15,927	25,815
Total income	1,107,905	1,016,090
Surplus after charges	614,078	560,488

AMERICAN GAS & ELECTRIC SUBSIDIARIES.

Five of the subsidiaries of the American Gas & Electric Company, New York, report earnings for July, 1912, and the 12 months ended July 31, 1912, as follows:

ATLANTIC CITY (N. J.) ELECTRIC.

	1912	1911
July gross	$ 49,509	$ 44,159
July net	35,680	26,979
July surplus	27,097	19,175
12 months' gross	441,018	399,738
12 months' net	262,643	211,700
12 months' surplus	160,604	128,546

CANTON (O.) ELECTRIC.

	1912	1911
July gross	$ 25,596	$ 20,201
July net	12,288	9,254
July surplus	7,569	4,478
12 months' gross	334,378	293,530
12 months' net	165,026	156,965
12 months' surplus	107,955	101,284

MUNCIE (IND.) ELECTRIC.

	1912	1911
July gross	$ 27,204	$ 19,588
July net	8,719	7,647
July surplus	2,133	1,787
12 months' gross	357,692	294,990
12 months' net	151,425	111,345
12 months' surplus	76,475	52,362

ROCKFORD (ILL.) ELECTRIC.

	1912	1911
July gross	$ 27,601	$ 25,322
July net	9,756	11,227
July surplus	1,943	3,570
12 months' gross	404,247	374,597
12 months' net	191,877	153,517
12 months' surplus	98,305	69,843

WHEELING (W. VA.) ELECTRIC.

	1912	1911
July gross	$ 18,769	$ 15,760
July net	8,363	6,886
July surplus	4,324	3,597
12 months' gross	245,705	186,671
12 months' net	123,021	99,058
12 months' surplus	76,805	82,354

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Aug. 24.	Aug. 19.
Allis-Chalmers common (New York)	...	1½
Allis-Chalmers preferred (New York)	5½	5¼
American Tel. & Tel. (New York)	145¼	145⅝
Commonwealth Edison (Chicago)	139	139
Edison Electric Illuminating (Boston)	...	289½
Electric Company of America (Philadelphia)	12¼	*12¼
Electric Storage Battery common (Philadelphia)	56⅞	57⅜
Electric Storage Battery preferred (Philadelphia)	...	57⅜
General Electric (New York)	182	182
Kings County Electric (New York)	...	129
Manhattan Transit (New York)	2⅛	2¼
Massachusetts Electric common (Boston)	18¾	19
Massachusetts Electric preferred (Boston)	77	*94
National Carbon common (Chicago)	116	120
National Carbon preferred (Chicago)	117¼	118
New England Telephone (Boston)	...	153
Philadelphia Electric (Philadelphia)	23⅝	24
Postal Telegraph and Cables common (New York)	..	87
Postal Telegraph and Cables preferred (New York)	..	69
Western Union (New York)	81½	83
Westinghouse common (New York)	87½	86¼
Westinghouse preferred (New York)	...	123⅛

*Last price quoted.

PERSONAL MENTION.

JAMES T. WHITTLESEY has resigned as chief engineer of the Public Service Electric Company, Newark, N. J., to engage in consulting practice in San Francisco, Cal.

EGBERT DOUGLAS, who for the past two years has been sales manager of the Milwaukee Electric Railway & Light Company, Milwaukee, Wis., has accepted the appointment of managership of the Consumers' Power Company, with headquarters at St. Paul, Minn.

JAMES H. MASON, general manager of the Simplex Electrical Company, Cambridge, Mass., was married on August 26 to Miss Mary Gould at the home of the bride's mother, Mrs. George Gould, at Wolfboro, N. H.

E. M. WALKER, general manager of the Muscatine Citizens' Railway & Light Company, has been appointed head of the Dubuque Union Electric Company, Dubuque, Iowa, succeeding Samuel A. Freshney, of Grand Rapids, who came to Dubuque temporarily.

E. L. CALLAHAN, manager of the New Business Department of H. M. Byllesby & Company, of Chicago, has been elected secretary of the Commercial Section of the National Electric Light Association. In addition Mr. Callahan will continue to act as chairman of the Committee on Commercial Section Digest.

BERTRAM M. DOWNS, of the Hemingray Glass Company, of Covington, Ky., was one of the well known manufacturers at the Niagara Falls convention of the Electrical Supply men and was warmly greeted by scores of friends, who congratulated him upon his complete recovery from a recent severe illness. Mrs. Downs accompanied her husband to the convention.

OBITUARY.

JOSEPH LE CONTE DAVIS, engineer in charge of design of direct-current railway type motors of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., who died August 5, was graduated from the University of South Carolina in 1897 with the degree of Electric Engineer. He was professor of physics at Bingham Academy High School in North Carolina from 1897 to 1900. He entered the employ of the General Electric Company at Schenectady, N. Y., and was engaged in engineering work for this company from 1900 to 1904. Mr. Davis was also at one time in charge of the development of the National Electric Signaling Company, which embraces the Fessenden wireless system. Since 1904 he was employed by the Westinghouse Electric & Manufacturing Company as a designer in the electric railway department. Mr. Davis was regarded as one of the brightest and most promising of the younger electrical engineers of the present day. His work in connection with the design of the direct-current motors used on the Pennsylvania terminal electrification and many other large installations had brought him into great prominence before the electrical men of the country and his loss will be a great one to the engineering profession at large.

NEW INCORPORATIONS.

LONDON, ONT. — Chishold-Dunn Telephone Appliance Company has been incorporated with a capital stock of $100,000.

BOSTON, MASS.—Commonwealth Gas & Electric Company has been incorporated with a capital stock of $41,000 by Josiah Q. Bennett, Alonzo F. Weeks, Elihu G. Loomis, Bowen Tufts and Paul B. Webber.

NEW YORK CITY, N. Y.—The Canton Electric Lamp Company has been incorporated with a capital stock of $10,000 by Lewis Demby, Brooklyn, N. Y., and Irving and Philip Nemoff, of New York City.

NEW YORK, N. Y.—The New York Electric Vehicle Association, Incorporated, has been incorporated with a capital stock of $50,000 by George Tiernan, Frank H. Parcells and Robert G. Reblefsen, all of New York City.

CHICAGO, ILL.—The Practical Electricity and Engineering Company has been granted a charter by the Secretary of State with capital stock of $50,000 to publish magazines, books, etc. The incorporators are Joseph G. Branch, A. W. Rathbun and N. L. Frost.

PHILADELPHIA, PA.—The Civic Service Corporation has been incorporated with G. Henry Stetson as president and A. L. Osgood, general manager. The purpose of the company is to take over and operate gas, electric light and power, water works, traction systems and heating plants. The company was formed to take over the public utility and general engineering business which has been conducted by T. Wilson Battin and A. L. Osgood.

ANGOLA, IND.—Angola-Waterloo Utilities Company has filed articles of incorporation with the Secretary of State. The capital stock is $65,000. The object of this corporation is to purchase, acquire, maintain, extend, and improve the electric railroad running between Angola and James Lake; to purchase, extend, improve, maintain and operate an electric light plant in the city of Angola and furnish the inhabitants with electricity for light, heat and power, and also to construct and operate transmission lines to furnish light, heat and power to the people of Stuben and Dekalb Counties. J. W. Durfee, T. S. McGrath and James J. Elliott are directors. S.

ANGOLA, IND.—Indiana Utilities Company has been incorporated with a capitalization of $200,000. The object of this corporation is to purchase, acquire, maintain, extend, and improve the electric railroad running between Angola and James Lake, and to purchase or otherwise acquire, construct, maintain and operate an electric light plant in the city of Angola and furnish the city and the country adjacent thereto, with electricity for light, heat and power purposes, and to deal in electrical appliances usually sold by lighting companies. The company will also construct operate and maintain transmission lines to furnish electricity for light, heat and power to the inhabitants of Stuben and Dekalb Counties, and to secure and possess franchises, grants, etc., from municipal authorities for the supplying of light, heat and power. John E. Van Metter, H. L. Hanley and A. M. Stielhamer are the incorporators. S.

PROPOSALS.

ELECTRICAL EQUIPMENTS.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until September 24 for miscellaneous electrical equipments, as per Schedule 4,800.

MOTOR-DRIVEN ENGINE LATHE.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until September 17 for one motor-driven engine lathe to be delivered at the Navy Yard, Hingham, Mass., as per Schedule No. 4790.

MOTOR-DRIVEN MILLING MACHINE.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until September 17 for one motor-driven milling machine to be delivered at the Navy Yard, Hingham, Mass., as per Schedule No. 4790.

EXTENSION OF ELECTRIC PLANT.—A considerable sum will be spent in new construction at the Norfolk (Va.) Navy Yard during the present fiscal year. An appropriation for $145,000 has been made to provide for these improvements which include the extension of the electric plant.

ELECTRIC PASSENGER ELEVATOR.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until October 4 for an electric passenger elevator for the post office and courthouse at North Yakima, Wash. Copies of drawings, etc., may be obtained from the office of the Supervising Architect.

ELECTRIC ELEVATOR.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until September 9 for the installation complete of an electric passenger elevator in the post office and court house at Phoenix, Ariz., in accordance with drawings and specifications, which may be obtained from the office of the custodian or from the Supervising Architect.

CONDUIT AND WIRING.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until October 3 for the conduit and wiring for the United States Marine Hospital at Stapleton, Staten Island, N. Y., in accordance with the specifications and drawings enumerated therein, copies of which may be obtained from the Chief Supervising Engineers, 727 Customhouse, New York City, or at the office of the Supervising Architect.

WIRING AND LIGHT FIXTURES.—Sealed proposals indorsed "Proposals for Electric Lighting System" will be received at the Bureau of Yards and Docks, Navy Department, Washington. D. C., until September 21 for the electric wiring and fixtures for the new general foundry building at the Navy Yard, Puget Sound, Wash., the estimated cost of which will be $2,000. Plans and specifications may be obtained upon application to the Bureau or to the Commandant of the Navy Yard.

ELECTRIC CONDUITS AND WIRING AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., for electric conduits and wiring and interior lighting fixtures, until September 27, of a one-story building for the post office at Paragould, Ark., until October 1 of a three-story building for the post office at Raleigh, N. C., until October 2 of a one-story building for the post office at Bellefontaine, O. Copies of drawings and specifications may be obtained from the usual places.

With the Electrical Manufacturers

Pittsburgh Transformer Company, Pittsburgh, Pa., has issued a folder describing the 28 transformers it supplied to the City of Chicago for the new street-lighting substations.

Archer & Baldwin, 114 Liberty Street, New York City, is sending out their September monthly list of used electrical and steam machinery, powerhouse equipment, cars, etc., which includes many bargains in apparatus of this character.

The R. W. Electric Company, manufacturers of the Robert Witz system of window-sign reflectors, illustrated and described in the issue of August 24 of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, has moved into larger quarters at 1770-1772 Ogden Avenue, Chicago, Ill.

The Franks Manufacturing Company, Rock Island, Ill., was recently incorporated with a capital stock of $30,000. The company has ample capital to push its line of adjustable fixtures, and will develop and add to this line. Thus far the company's products have met with gratifying favor.

Standard Electric Tool Company, Cincinnati, Ohio, has issued bulletins Nos. D-5 and D-6 describing and illustrating the Standard high-power electric grinders and drills. These tools are the product of many years' development and are said to be exceptionally powerful and rugged.

The Bryan-Marsh Electric Works of the General Electric Company, Chicago, Ill., has opened a new office in Kansas City, Mo., at 908 Broadway. This branch will be under the management of Sam Furst, who for many years has been connected with the Bryan-Marsh organization.

The Esterline Company, Lafayette, Ind., has a capital stock of $250,000. One half of this was recently purchased by Carl Fisher and J. G. Allison, owners of the Presto-lite Company, Indianapolis. Although the Lafayette plant will be moved to Indianapolis, there will be no change in the management of the company.

Allis-Chalmers Company, Milwaukee, Wis., has issued Bulletin No. 1629 devoted to horizontal and vertical hydraulic turbines with cylindrical plate steel casings and single or twin runners of types E or F. These turbines are particularly suitable for direct connection to electric generators. The bulletin describes the construction of these machines in detail and gives very complete power and speed tables applying to them.

The Hatzung Manufacturing Company, 220 West Genesee Street, Syracuse, N. Y., has been organized to engage in the manufacture of electric and combination lighting fixtures, and also to deal in the parts and accessories. A specialty will be made of hand work from original designs. The company wishes to get in touch with manufacturers and dealers of this material. Alexander H. Hatzung and J. E. Terwilliger are the proprietors of the new company.

Western Electric Company reports that its business for July was three per cent greater than that of July, 1911. Particularly good showing was made in the general supply and lighting departments and in foreign business. At the end of July the company had 27,000 employees, 4,000 more than at the beginning of the year. Over 11,000 of these are engaged at the Hawthorne plant, where additional new buildings costing about $750,000 will be erected soon to permit still further concentration of the manufacturing work at this plant.

Trumbull Electric Manufacturing Company, Plainville, Conn., has issued its new knife-switch bulletin. This is a 92-page book that embodies a new method of listing and arrangement. The tables have been entirely rearranged, giving a much more convenient arrangement than formerly. Drilling dimensions have all been changed and over-all dimensions added for convenience in figuring for boxes. Back-connected 600-volt switches and a 200-ampere type C switch are among the new additions. Copies of the bulletin may be secured on request.

Pass & Seymour, Incorporated, Solvay, N. Y., has ready for distribution its new general catalog No. 20. This gives a complete illustrated listing of the many electrical wiring devices manufactured by the company. Particular attention is given to the very complete line of Fluto and Passmour keyed, keyless and pull sockets and receptacles, to the Shurlock locking device, and to numerous B & S sockets, rosettes, outlet-box receptacles, cleats, tubes, plugs, pendent switches, etc. All needed information is given about each device. Copies of this interesting catalog may be obtained by sending a request to the company.

The Naugle Pole & Tie Company, 5 South Wabash Avenue, Chicago, is making a strong announcement to the trade urging the ordering of poles without delay. The company announces that it will be advisable to get in inquiries now as prices are higher than last year, and there is every prospect of an advance. Another matter of importance is the fact that the railways are advising all merchants along their lines to stock up early on account of the extraordinarily heavy movement of grain that is assured this fall. At the present time cars are plentiful, but the near future will probably bring a great shortage.

The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa., has issued a series of bulletins on new scientific electrical apparatus. One describes a new type of galvanometer lamp and scale that is ingeniously mounted on the galvanometer itself. An electrically driven synchronizing fork for use with a rotary converter in producing a rotary motion of constant angular velocity and an alternating current of constant frequency is described in another bulletin. Still another is devoted to the deflection potentiometers designed by H. B. Brooks of the Bureau of Standards, Washington, D. C. Catalog No. 30 illustrates and describes an assortment of keys for electrical testing in college and high school laboratories.

The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, has published a booklet which gives a simplified method for the planning of indirect lighting installations. The table of contents includes an explanation of the method, a discussion of reflectors, outlets, distance to ceiling, fixtures and interior equipment. Concrete examples of the physical and illuminating data and the plans resulting from a study of these are given. The subjects studied specifically include hotels and clubs, barber shops, lobbies, restaurants, churches and auditoriums, theatres, stores and display rooms, residences, schools and colleges, drafting rooms, libraries, museums, hospitals and special installations. There is also a table of foot-candle intensities. Copies of this booklet may be secured by making request for bulletin No. 3.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., reports that among the large orders recently received for power-station apparatus is one from the Philadelphia Electric Company for one 1,000-kilowatt, 280-volt, two-phase, 60-cycle synchronous-booster rotary converter and two 550-kilowatt, 13,200-volt, 60-cycle, air-blast transformers. An order was received from the Cleveland Railway Company for two 1,000-kilowatt and nine 1,500-kilowatt, 600-volt, 60-cycle interpole rotary converters; 28 550-kilowatt, 60-cycle air-blast transformers, and seven similar ones of 365-kilowatt capacity. The Commonwealth Edison Company, Chicago, Ill., has ordered two 4,000-kilowatt, 600-volt, 25-cycle rotary converters, and two 4,400-kilowatt, three-phase, 25-cycle, 9,000-volt air-blast transformers complete with reactance coils and blower sets; also one 19-panel marble switchboard. One 1,500-kilowatt, three-phase, 60-cycle, 2,400-volt turbogenerator with a 25-kilowatt, direct-connected exciter, has been ordered by the Sandusky Gas & Electric Company, Sandusky, Ohio. The United Gas & Electric Company, of Harrisburg, Pa., has ordered one 2,500-kilowatt, three-phase, 60-cycle, 2,300-volt turbogenerator. The company has received an order from W. H. Schott, Chicago, Ill., for three 1,250-kilowatt, three-phase, 25-cycle, water-wheel generators with two 100-kilowatt exciters. There was re-

ceived an order from the White River Construction Company, Joplin, Mo., for 19 25-cycle, single-phase transformers ranging from 2,667 to 250 kilovolt-amperes in rating and having primary voltages of 66,000 and 33,000; seven of these units are water-cooled. The same company also ordered a 1,250-kilowatt frequency changer for changing 25 to 60 cycles and vice versa.

DATES AHEAD.

American Electrotherapeutic Association. Richmond, Va., September 3-4.

International Association for Testing Materials, Sixth congress, New York City, September 3-7.

Pennsylvania Electric Association. Annual convention, Bedford Springs Hotel, Bedford Springs, Pa., September 4-6.

Eighth International Congress of Applied Chemistry. Washington, D. C., September 4, New York, N. Y., September 6-13.

American Electrochemical Society. Fall meeting in conjunction with Electrochemical Section of International Congress, New York, N. Y., September 7, 9 and 10.

Association of Edison Illuminating Companies. Annual convention, Hot Springs, Va., September 10-12.

Illuminating Engineering Society. Annual convention, Hotel Clifton, Niagara Falls, Ont., September 16-19.

Association of Iron and Steel Electrical Engineers. Annual convention, Hotel Pfister, Milwaukee, Wis., September 23-28.

The 1912 Boston Electric Show, Mechanics' Building, Boston, Mass., September 28-October 26.

American Electric Railway Association and its five affiliated associations. Annual convention, Chicago, Ill., October 7-11.

The New York Electrical Exposition and Automobile Show. The New Grand Central Palace, New York City, October 9-19.

Electric Vehicle Association. Annual convention, Boston, Mass., October 8.

New England Section of the National Electric Light Association. Fall meeting, Boston, Mass., October 10 and 11.

Sons of Jove. Annual convention, Pittsburgh, Pa., October 14-16.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Manhattan, Kans. October 17-19.

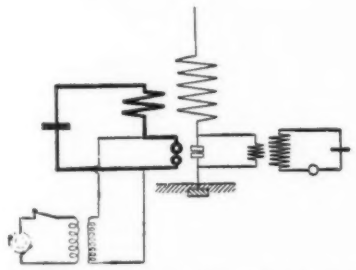
Association of Telephone Pioneers of America. Annual convention, New York City, November 14-15.

Record of Electrical Patents.

Issued by the United States Patent Office, August 20, 1912.

1,035,861. Advertisement Apparatus. E. E. Courtin, Paris, France. Is intermittently driven by an electric motor.

1,035,873. Process for Producing Endothermic Gas Reactions and Apparatus Therefor. H. Grohmann, assignor to Salpetersäure-Industrie Gesellschaft, G. M. B. H., Cologne, Germany. The reaction takes place in an electric furnace with a pear-shaped chamber between the electrodes.



1,035,958.—Wireless Protective Spark Gap.

1,035,879. Portable Electric Light. C. Hubert, New York, N. Y. A casing containing a dry cell has a miniature lamp at one end and a contact button on the side.

1,035,883. Manufacture of Exceedingly Thin Metallic Glowing Filaments for Electric Incandescent Lamps. A. Lederer, Atzgersdorf, Austria-Hungary. Are made from paste containing powdered tungsten, zinc oxide and a carbonaceous agglutinant.

1,035,894. Gas-Feed Valve for Vacuum Tubes. D. McF. Moore, assignor to General Electric Co. For use with Moore tubes.

1,035,919. Reduction of Boron Compounds. F. J. Tone, Niagara Falls, N. Y. Calcium borate, carbon and iron are fused in an electric resistance furnace to form ferro-boron.

1,035,958. Protective Apparatus for Radio-Telegraphic Stations. E. Girardeau, Paris, France. The receiving apparatus contains a protecting spark gap adjoining that of the transmitter so as to be subject to the ultra-violet rays of the latter.

1,035,964. Machine for and Method of Electric Welding. E. I. Heinsohn and W. R. Edwards, assignors to Cleveland Welding & Manufacturing Co., Cleveland, O. Tubes are welded by applying a heating current and a torque simultaneously to the abutting edges.

1,035,971. Selective Signaling Apparatus. D. W. Kneisly, assignor to Dayton Telephone Lockout Manufacturing Co., Dayton, O. Includes a remote-controlled make-and-break mechanism.

1,035,986. Trolley-Pole Construction. A. K. McQuade, Pittsburgh, Pa. The turntable on which the pole is mounted can be reversed by a cable from either end of the car.

1,036,010. Weatherproof Electrical Receptacle. F. J. Russell, New York, N. Y. Within the body is a spiral-wire plug holder.

1,036,019. Electric Snap Switch. T. M. Smith, New York, N. Y. A pear-shaped casing has a rotary switch in the rounded part and a pair of terminal clips in the upper part.

1,036,056. Impulse Transmitter. C. R. Austin, assignor to Southern California Manufacturing Co., Los Angeles, Cal. Includes a dial, an indicator, a traveling brush, a magnet-operated pawl and a ringing circuit.

1,036,063. Ventilating and Cooling System for Batteries. C. H. Bedell and G. E. Edgar, New London, Conn. A number of cells are arranged in a sealed tank; to each cell is piped cooling air below and ventilating air above.

1,036,064. Outdoor Electric-Lighting Fixture. R. B. Benjamin, assignor to Benjamin Electric Manufacturing Co., Chicago, Ill. An incandescent-lamp cluster with an inclosing hood and diffusing globe.

1,036,077. Switchboard and Rheostat. E. M. Crane, assignor to Pelton & Crane, Detroit, Mich. The rheostat consists of two fixed and a round adjustable resistance.

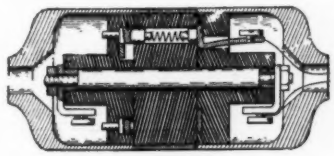
1,036,089. Electrical Office-Indicator. J. C. Gabel, Champaign, Ill., assignor of one-half to C. N. Cadwell. Includes a box with an open front, a battery, lamp and push-button.

1,036,112. Trolley Splice. E. Heydon, Indianapolis, Ind. Has two arms whose flanges are crimped around the trolley wire.

1,036,115. Switch-Lock for Ignition Circuits. P. Hoffman and T. H. Hupfer, St. Louis, Mo. A key-operated tumbler lock for protecting the igniter switch.

1,036,116. Automatic Temperature-Regulator. H. Hohlmann, Jr., assignor to M. Rothschild, Dortmund, Germany. Includes an electrically operated valve for admitting temperature-regulating liquid.

1,036,126. Electric Switch. F. Kuhn and F. E. Shailor, assignors to American Electrical Heater Co., Detroit, Mich. The central section of a cylindrical casing has a bridging piece between an adjoining ring contact and a set of opposed contacts.



1,036,126.—Cylindrical Switch.

1,036,136. Tool for Stringing Line-Wires. H. A. Menager, assignor of nine-tenths to J. A. Menager, Holden, W. Va. A U-shaped strap with wire-receiving slots in its upstanding flanges fits around the insulator.

1,036,137. Blast Furnace. A. J. Moxham, Wilmington, Del. A series of electromagnets is arranged in tiers near the top of the furnace to prevent the escape of ore dust in the outgoing gases.

1,036,143. Terminal for Igniters. R. M. G. Phillips, Minneapolis, Minn., assignor to H. Deutsch. Gives details of a binding-post construction.

1,036,176. Explosive Charge and Explosive Body for Projectiles, Mines, and Torpedoes. C. E. Bichel, assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. Is given a conductive coating and one or more metals are electrodeposited thereon.

1,036,177. Electrical Distributing Cabinet. A. E. Blackman, Mount Vernon, N. Y. An outlet box made of adjoining sections detachably secured together.

1,036,286. Trolley. G. E. Lynch, Chelsea, Mass., assignor to Jeffrey Manufacturing Co. Relates to the spring means for keeping the trolley pole in normal working position.

1,036,293. Switch and Cutout Device. A. V. A. McHarg, New York, N. Y. On one side of an insulating block are fuses, on the other is a multiple knife switch for short-circuiting them.

1,036,294. Switch. A. V. A. McHarg, New York, N. Y. A lamp-socket switch with an operating push rod reciprocating through the socket.

1,036,296. Connector for Electrical Conduits. A. McMurtrie, New York, N. Y. Has attaching and seat portions and a separate connector strap.

1,036,304. Electrical Resistance. A. Misland, Boyonne, N. J. A spirally wound bare coil with its small end secured to a terminal and its large end to a short-circuiting cone.

1,036,326. Electric Pull-Socket Switch. W. Pfeifer, Jr., Jersey City, N. J. A nut on the central contact screw has two reversely slanting side flanges co-operating with a square plate on top that is moved by the pull chain.

1,036,328. Auxiliary Power for Pumping. W. T. Pierce, Cambridge, Mass. A plunger pump is operated by an electric motor when no steam power is available.

1,036,331. Fly and Mosquito Destroyer. J. T. Plumer, Yale, Ky. An electric fan motor drives radial whips in a ring instead of fan blades.

1,036,344. Primary Battery. A. L. Saltzman, assignor to Thomas A. Edison, Inc., West Orange, N. J. A supporting hanger for electrodes is secured to the jar cover.

1,036,356. Distributer for Electric Ignition Gear. F. R. Simms, assignor to Simms Magneto Co., New York, N. Y. A rotable circuit-breaker with a distributer arm.

1,036,363. Apparatus for Producing Carbon Black. J. A. Snee, West Elizabeth, Pa. Includes an electrically heated retort.

1,036,372. Electric Signaling System. J. D. Taylor, assignor to Union Switch & Signal Co., Swissvale, Pa. The rails near the ends of the blocks have increased resistance.

1,036,373. Railway Signaling Mechanism. J. D. Taylor, assignor to Union Switch & Signal Co. The semaphore arm is moved to and held in "clear" position by an electric motor.

1,036,377. Signal Lantern. C. Ambrose Thompson, Relay, and D. Pierce, Elkridge, Md. Either an electric lamp or oil burner can be moved into focal position.

1,036,393. Street-Lighting Crane. F. E. Wilkinson, Oakland, Cal. Has a horizontal tubular arm on which the lamp fixture is moved by a rope and pulleys.

1,036,402. Trolley Pole. W. L. Wright, Philadelphia, Pa. Is made of two sheet-metal sections longitudinally united.

1,036,411. Electrical Advertising Device. N. O. Anderson and F. O. Hutchings, San Francisco, Cal., assignors to Excelsior Advertising Device Co. Has a number of brushes bearing on the segmental contacts of a rotatable table to control multi-colored lamps.

1,036,417. Distant-Control Electric Switch. C. C. Badeau, assignor to Sears B. Condit, Jr., Brookline, Mass. An electromagnetically operated oil switch.

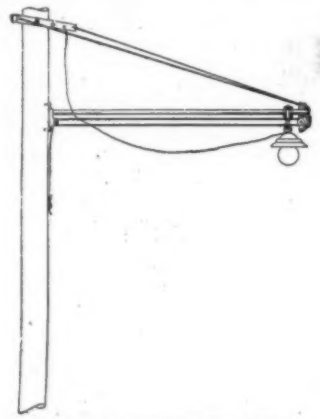
1,036,418. Combined Socket and Switch for Electric Lights. D. A. Bailey, Fort Worth, Tex. Has one key for closing the circuit for a number of sockets and another key for short-circuiting them.

1,036,423. Protecting Device for Meter Connections. P. H. Bartlett, Philadelphia, Pa. Has an adapter box between the meter casing and the connection box.

1,036,443. Telegraph Key. G. V. Buquoi, St. James, La. One of the levers carries an adjustable weight which causes its vibration when the key is operated, thus making and breaking contact and automatically repeating the impulses.

1,036,445. Series Transformer. G. A. Burnham, assignor to S. B. Condit, Jr., Brookline, Mass. Has a special compensating coil in the secondary circuit to maintain the ratio of transformation constant for different loads.

1,036,456. Incubator. J. G. Congreve, New York, N. Y. Contains electric heaters thermostatically controlled.



1,036,393.—Street-Lighting Crane.

1,036,457. Trolley. N. B. Coon, North Braddock, Pa. Has special wearing blocks and gripping members for the trolley wire.

1,036,471. Storage Battery. T. A. Edison, assignor to Edison Storage Battery Co., West Orange, N. J. Powdered nickel hydroxide is mixed with about 20 per cent of a powdered bismuth compound for the nickel plates.

1,036,477. Trolley-Supporting Mechanism. D. T. Fisher, Columbus, O. assignor to Jeffrey Manufacturing Co. The socket and spring are depressed below the top of the mining locomotive or car.

1,036,482. Apparatus for Constructing or Repairing Lines of Wire. E. A. Fredeen, Wahpeton, N. D. Includes special means for raising a bar and ladder.

1,036,488. Culinary Machine. H. F. Hall, assignor to Enterprise Manufacturing Co. of Pennsylvania, Philadelphia, Pa. Is driven by a vertical electric motor mounted over the vessel.

1,036,489. Culinary Machine. H. F. Hall, assignor to Enterprise Manufacturing Co. of Pennsylvania. The motor is mounted beneath the vessel.

1,036,507. Meter-Testing Connection Block. T. E. Murray, New York, N. Y. The meter-circuit terminals are arranged in a cavity with a spring circuit-closer and co-operate with a gang plug.

1,036,508. Connection Device for Circuit Conductors. T. E. Murray, New York, N. Y. A number of insulating blocks, each with two sockets, can be interconnected by means of bridging connector blocks.

1,036,509. Method of Forming Integral Flanges on Bodies of Ductile Metal. T. E. Murray, New York, N. Y. A flange is formed around a cable sheath by running lead floss about it in a mold.

1,036,510. Electric Fuse. T. E. Murray, New York, N. Y. A core with dovetailed projections on oposite sides has a fuse wound around it several times and across the projections.

1,036,527. Diffusing Container for Incandescent Lights. P. C. Hewitt, Ringwood Manor, N. J. The tube or bulb of the lamp has fine, shallow, etched grooves on its exterior parallel with the linear light source.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired August 27, 1912.

545,042. Hysteresis Compensator. B. Abdank-Abakanowicz, St. Maur, France.

545,069. Electric Annunciator. G. J. Galbraith, Boston, Mass.

545,070. Underground Electric Railway. D. F. Graham, Springfield, O., and W. P. Allen, Chicago, Ill.

545,076. Thermostat. G. Hill, New Brunswick, N. J.

545,091. Electric Gas-Lighting Apparatus. J. W. Palmer, Nashua, N. H.

545,111. Means for Synchronizing Electric Motors. E. Thomson and E. W. Rice, Jr., Swampscott, Mass.

545,149. Electromagnetic Tool. C. F. Carpenter, Louisville, Ky.

545,158. Electric Railway. J. C. Henry, Westfield, N. J.

545,191. Telephone Holder and Cutout. A. F. Boardman, Somerville, Mass.

545,204. Conduit Electric Railway. C. H. Johnson, San Jose, Cal.

545,208. Underground Electric Railway. E. E. Moore, Chicago, Ill.

545,230. Automatic Switch for Electric or Cable Railways. G. T. Janvrin and F. J. Conlin, Brooklyn, N. Y.

545,253. Combined Telephone-Rereceiver Support and Switch. G. F. Shaver, Yonkers, N. Y.

545,282. Means for Indicating Coincidence of Phase of Two Alternating or Polyphase-Current Machines. J. H. F. Gorfes, Berlin, Germany.

545,296. Electric Conduit. C. J. Kintner, New York, N. Y.

545,327. Electric Target. M. T. Weston, Kenton, O.

545,357. Electric Signaling Device. W. Gillette, New York, N. Y.

545,358. Trolley-Controller for Electric Railways. L. W. P. Gray and P. G. Doescher, New Orleans, La.

545,359. Electric Arc Lamp. H. T. Harrison, London, Eng.

545,393. Guard and Guide for Electric Trolleys. J. R. Trisler, Westwood, O.

545,402. Telephone and Return-Call System. T. R. Brinmer, Baltimore, Md.

545,404. Electrically Operated Mine Car. H. B. Dierdorff, Columbus, O.

545,405. System of Electrical Distribution. T. A. Edison, Llewellyn Park, N. J.

545,416. Telephone. G. F. Shaver, Yonkers, N. Y.